48th - 48ième

Annual Meeting - Réunion Annuelle
2016
Vancouver, British Columbia
Canada
September 22-24 Septembre
CAPS 2017 Annual Meeting
ACCP 2017 Réunion Annuelle

October 5-7 Octobre
Banff, Alberta
Canada

PLAN TO JOIN US!
Joignez-vous à nous!
CANADIAN ASSOCIATION of
PAEDIATRIC SURGEONS
ASSOCIATION CANADIENNE de
CHIRURGIE PÉDIATRIQUE

48th Annual Meeting
48 ième Réunion Annuelle

September 22-24 Septembre 2016
The Westin Bayshore, Vancouver
Vancouver, British Columbia
CANADA
This event is an Accredited Group Learning Activity (Section 1) as defined by the Maintenance of Certification Program of the Royal College of Physicians and Surgeons of Canada and approved by UBC Continuing Professional Development, Faculty of Medicine for which an attendee may claim up to 16.5 credits (1 hour = 1 Maincert credit). Participants should claim the number of hours consistent with their attendance.

Cet événement est une activité de formation collective agrée (section 1) tel que défini par le programme de Maintien du Collège Royal des Médecins et Chirurgiens du Canada et approuvé par la Division de développement professionnel continu de la faculté des médecins de l'Université Colombie Britannique pour lesquels un participant peut avoir jusqu’à 16.5 crédits (1 heure = 1 Maincert crédit). Les participants devraient déclarer le nombre d'heures compatibles avec leur présence.

In keeping with CMA Guidelines, program content and selection of speakers are the responsibility of the planning committee. Support is directed toward the costs of the course and not to individual speakers. All speakers have indicated no involvement with industry that may be perceived as potentially influencing the presentation of the educational material.
Educational Objectives

The Annual meeting of the Canadian Association of Paediatric Surgeons is intended to provide 3 days of comprehensive continuing education in the field of pediatric general and thoracic surgery. Specifically, the objectives are to:

- Present current updates on advances in clinical pediatric surgery
- Present current updates on advances in the pathophysiology of pediatric surgical disorders
- Provide for group discussion on controversial issues in pediatric general and thoracic surgery through:
  - Discussion of presented scientific papers
  - Interactive panel discussion on the management of clinical pediatric problems

Over the three days of the meeting, the breadth of pediatric general and thoracic surgery topics will be covered through presentation of original works by trainees, professional colleagues and allied health care workers involved in the field. The works will acquaint participants with the latest clinical and basic science research findings and trends influencing the clinical practice of pediatric surgery, as well as reacquaint participants with interesting pediatric surgical entities. Controversial topics will invite participatory discussion by the delegates.

A panel of 6 members of the CAPS Program Committee has chosen the abstracts presented, based on quality of abstracts submitted and reflecting what is commonly relevant to the practice of pediatric surgery. Input for subsequent meetings and how to improve this one will be solicited from the delegates at the conclusion of the meeting.
## MEETING ROOM SCHEDULE

<table>
<thead>
<tr>
<th>DATE</th>
<th>EVENT</th>
<th>TIME</th>
<th>LOCATION</th>
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</thead>
<tbody>
<tr>
<td><strong>Wednesday, September 21</strong></td>
<td>Executive Finance Meeting</td>
<td>08:00 – 11:45</td>
<td>Prospect Room</td>
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<td>Council Meeting</td>
<td>11:45 – 17:00</td>
<td>Prospect Room</td>
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<td>CAPSNet Meeting</td>
<td>17:00 – 19:00</td>
<td>Prospect Room</td>
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<tr>
<td><strong>Thursday, September 22</strong></td>
<td>Publications Meeting</td>
<td>06:30 – 10:00</td>
<td>Coquitlam Room</td>
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<td></td>
<td>RCPSC – Ped Surg</td>
<td>09:00 - 12:00</td>
<td>Cowichan Room</td>
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<td></td>
<td>Registration</td>
<td>09:00 – 17:00</td>
<td>Stanley Park Foyer</td>
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<tr>
<td></td>
<td>CaPSNIG Meeting</td>
<td>08:00 – 14:00</td>
<td>Salon 3</td>
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<td></td>
<td>Research Committee</td>
<td>07:30 – 09:00</td>
<td>Chehalis Room</td>
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<td></td>
<td>Social Media Committee</td>
<td>10:00-11:30</td>
<td>Chehalis Room</td>
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<td></td>
<td>Scientific Meeting Sessions</td>
<td>12:00 – 17:00</td>
<td>Salon 1 &amp; 2</td>
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<td>Speaker Ready Room</td>
<td>08:00 – 17:00</td>
<td>Tangent</td>
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<td></td>
<td>Welcome Reception &amp; Buffet</td>
<td>18:30 – 23:00</td>
<td>Vancouver Rowing Club</td>
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<tr>
<td><strong>Friday, September 23</strong></td>
<td>Education Committee</td>
<td>06:30-08:00</td>
<td>Cowichan Room</td>
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<td>Global Partnership Meeting</td>
<td>06:30-09:00</td>
<td>Chehalis Room</td>
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<td>Continental Breakfast</td>
<td>07:00 – 08:00</td>
<td>Stanley Park Foyer</td>
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<td>Registration</td>
<td>07:00 – 16:30</td>
<td>Stanley Park Foyer</td>
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<td></td>
<td>Speaker Ready Room</td>
<td>07:00 – 16:30</td>
<td>Tangent</td>
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<td></td>
<td>Meeting Sessions</td>
<td>08:00 – 16:30</td>
<td>Salon 1 &amp; 2</td>
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<td></td>
<td>Exhibits</td>
<td>07:00 – 17:00</td>
<td>Stanley Park Foyer</td>
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<td>Poster Viewing</td>
<td>07:00 – 17:00</td>
<td>Stanley Park Foyer</td>
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<td>All Breaks &amp; Lunch</td>
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<td>Stanley Park Foyer</td>
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<tr>
<td><strong>Saturday, September 24</strong></td>
<td>Annual Business Breakfast</td>
<td>06:30 – 07:00</td>
<td>Oak</td>
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<td></td>
<td>Annual Business Meeting</td>
<td>07:00 – 08:45</td>
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<td></td>
<td>Non-members Breakfast</td>
<td>08:00 – 09:00</td>
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<td></td>
<td>Registration</td>
<td>09:00 – 12:00</td>
<td>Stanley Park Foyer</td>
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<td>Exhibits</td>
<td>08:00 – 14:00</td>
<td>Stanley Park Foyer</td>
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<td></td>
<td>Poster Viewing</td>
<td>07:00 – 13:30</td>
<td>Stanley Park Foyer</td>
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<td></td>
<td>Speaker Ready Room</td>
<td>07:00 – 12:00</td>
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<td></td>
<td>Presidential Reception &amp; Banquet</td>
<td>18:30 – 24:00</td>
<td>Salon 1 &amp; 2</td>
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12th Annual Meeting September 22, 2016
The Westin Bayshore
Vancouver, BC
Salon 3

7:30 - 8:00 am  CaPSNIG business meeting - members only
                 Breakfast will be served

8:00 – 9:00 am  Introductions & Welcome
                 Dr. Erik Skarsgard Surgeon in Chief, Dept of Peds Surgery, BC Children’s
                 Monping Chiang & Kimberly Colapinto – Chair CaPSNIG
                 Coffee will be served

9:00 – 10:00 am 1st annual CaPSNIG motivation presentation (Kim Colapinto, Sick Kids)

10:00 – 10:30 am Midgut presentation (Monping Chiang, Sick Kids)

10:30 - 11:00 am Quality & Practice innovations
                Giant Omphalocele: Growing and Healing (Amie Nowak, BC Children’s)

11:00 - 12:00 pm Education Session (Dr. Rodrigo Romao, IWK)
                 Lunch will be served

12:00 – 12:30 pm Case study #1 “Take a Chance on me…” A case study of Collaboration, Innovation and
                 Determination (Hazel Pleasants, Sick Kids)

12:30 - 1:00 pm  Case Study #2 Innovative Surgical Approach in the Management of Intestinal Pseudo-
                 obstruction (Karen Steinberg, Sick Kids)

1:00 - 1:30 pm  Case Study #3 The sky is the limit: improving quality of life in children with complex
                 medical needs (Christina Kosar, Sick Kids)

1:30 - 2:00 pm  Evaluations
                 Closing remarks- Monping Chiang

CAPS conference to follow at 2:30 pm

This meeting was made possible by the generous donation of CAPS. Please thank your surgeons!
PRESIDENT'S WELCOME

Welcome to Vancouver and thank you for attending the 48th Annual Meeting of the Canadian Association of Paediatric Surgeons. We are very fortunate to be meeting in one of the most beautiful cities in Canada, with a spectacular view of the Pacific Ocean. We will enjoy an excellent scientific program as well as outstanding social events.

I would like to thank BJ Hancock, our hardworking secretary-treasurer, Priscilla Chiu, Program Committee Chair and Erik Skarsgard, Local Arrangements Chair for their hard work and dedication to making this meeting a success. A special thank you goes to Arlene Ein, our meeting coordinator, for making everything run like clockwork.

This year we welcome Dr. Shawn Rangel from Boston Children’s Hospital, Harvard Medical School, Boston, Massachusetts as our JPS/MacLeod lecturer. Dr. Rangel is a leader in the use of the American College of Surgeon’s National Surgical Quality Improvement Program (NSQIP) for Pediatric Surgery and the Director of Quality Improvement & Patient Safety, Department of Pediatric Surgery, Boston Children's Hospital.

The CAPS Annual meeting is a wonderful opportunity to share ideas, learn something new to take back to your respective hospitals and enjoy the company of our peers. I know you will enjoy Vancouver!

Peter Fitzgerald Hon BA, MA, MD, FRCSC

President
Canadian Association of Paediatric Surgeons
MOT DE BIENVENUE DU PRÉSIDENT

Bienvenue à Vancouver et merci pour avoir assisté à la 48e réunion annuelle de l'Association canadienne de chirurgie pédiatrique. Nous sommes très heureux d'être réunie à l'un des endroits les plus belle au Canada avec une vue magnifique à l'océan Pacifique. Cette année, nous avons à nouveau à la fois un excellent programme scientifique et des événements sociaux très extraordinaire.

Je tiens à remercier BJ Hancock, notre secrétaire-trésorier qui travaille très fort à chaque année, Priscilla Chiu, président du Comité du programme et Erik Skarsgard, président des arrangements locaux pour leur efforts et leur dévouement à faire de cette réunion un succès. Un merci tout spécial à Arlene Ein, notre coordinatrice de la réunion, pour faire tout fonctionner comme sur des roulettes.

Cette année, nous accueillons le Dr. Shawn Rangel à Boston comme notre professeur JPS / MacLeod. Il est un chef de NSQIP en chirurgie pédiatrique et le directeur de la qualité du département de chirurgie pédiatrique à l'hôpital des enfants à Boston.

La réunion annuelle de CAPS est une merveilleuse occasion d'échanger des idées, d'apprendre quelque chose de nouveau à ramener à vos hôpitaux respectifs et apprécier la compagnie de nos collègues. Je sais que vous allez profiter de Vancouver!

Peter Fitzgerald Hon BA, MA, MD, FRCSC
Président,
Association canadienne de chirurgie pédiatrique
ABOUT THE CANADIAN ASSOCIATION OF PAEDIATRIC SURGEONS

The Canadian Association of Paediatric Surgeons was granted its charter in 1967. Its goal is to improve the surgical care of infants and children in Canada. Its areas of interest include all aspects of general and thoracic pediatric surgery with recognition of its unique responsibility to infants born with congenital anomalies and children with malignancies. While its responsibility to pediatric trauma is not unique, it assumes a pivotal role in issues related to pediatric trauma.

The Canadian Association of Paediatric Surgeons presents an opportunity, particularly through its annual meetings, to share information concerning diagnosis, treatment, and research with regards to its areas of interest. In addition, it assumes responsibility to participate in the education of not only its members, but other members of the community interested in and involved in related aspects of pediatric care.

EDUCATION AND RESEARCH FUND: To help achieve its responsibility to education and research for issues related to pediatric surgery, the Association has an Education and Research Fund. This fund was established and continues to exist through the generosity of donations from individuals and groups, both medical and non-medical, interested in the surgical care of children. The Association solicits annual donations to the fund to maintain an adequate working capital to support annual education programs and research endeavors endorsed by the CAPS membership. This fund is registered with the federal government and all contributions are fully tax-deductible. It is audited annually.

Contributions to the Education and Research Fund can be made online at www.caps.ca or send a cheque to:

Dr. B.J. Hancock
CAPS Secretary-Treasurer
Children’s Hospital of Winnipeg
AE401 – 840 Sherbrook Street
Winnipeg, Manitoba R3A 1S1
Email: admin@caps.ca
Telephone: (204) 787-1246
Fax: (204) 787-4618
AU SUJET DE L’ASSOCIATION CANADIENNE DE CHIRURGIE PÉDIATRIQUE

L'Association canadienne de chirurgie pédiatrique a reçu sa charte en 1967. Son objectif est d'améliorer les soins chirurgicaux aux nouveau-nés et aux enfants du Canada. Elle s'intéresse à tous les aspects de la chirurgie pédiatrique générale et thoracique tout en reconnaissant sa responsabilité unique à l'égard des bébés nés avec des anomalies congénitales et des enfants atteints de tumeurs malignes. Bien que sa responsabilité en matière de traumatismes pédiatriques ne soit pas unique, elle exerce un rôle crucial dans les questions relatives à ces traumatismes.

L'Association canadienne de chirurgie pédiatrique offre la possibilité, particulièrement dans le cadre de son assemblée générale annuelle, d'échanger des informations concernant le diagnostic, le traitement et la recherche liés à ses domaines de travail. De plus, elle assume la responsabilité de participer à l'éducation non seulement de ses propres membres, mais aussi des autres membres de la communauté qui s’intéressent à des aspects apparentés des soins pédiatriques et qui travaillent dans ces domaines.

LE FONDS D’ÉDUCATION ET RESEARCH: Pour l’aider à remplir ses engagements en matière d’éducation et du research sur les sujets relatifs à la chirurgie pédiatrique, l’association a créé un fonds pour l’éducation et research. Ce fonds a été établi et continué d’exister grâce à la générosité des individus et des associations, de nature médicale ou autre, intéressées par les soins chirurgicaux aux enfants. L’association sollicite annuellement des dons en faveur de son fonds afin de maintenir un fonds de roulement suffisant pour soutenir les programmes d’éducation et les projets des research approuvés par les membres de l’ACCP. Ce fonds est enregistré auprès du gouvernement fédéral et toutes les contributions sont pleinement déductibles d’impôts. Le fonds fait l’objet d’une vérification comptable annuelle.

Les dons pour le fonds d’éducation et du research peuvent être envoyés par courriel à www.caps.ca ou adressés par chèque à :

Dr. B.J. Hancock
Secrétaire-trésorier de l’ACCP
Children’s Hospital of Winnipeg
AE401 – 840 Sherbrook Street
Winnipeg, Manitoba R3A 1S1
Email: admin@caps.ca
Telephone: (204) 787-1246 Fax: (204) 787-4618
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<th>Year</th>
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<td>1967-1973</td>
<td>Harvey Beardmore*</td>
<td>Montreal</td>
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<td>1973-1975</td>
<td>Colin Ferguson*</td>
<td>Winnipeg</td>
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<td>1975-1977</td>
<td>Jim Simpson*</td>
<td>Toronto</td>
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<td>Sam Kling*</td>
<td>Edmonton</td>
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<td>Pierre-Paul Collin</td>
<td>Montreal</td>
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<td>1981-1983</td>
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<td>Toronto</td>
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<td>1983-1985</td>
<td>Gordon Cameron</td>
<td>Hamilton</td>
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<tr>
<td>1985-1987</td>
<td>Stanley Mercer*</td>
<td>Ottawa</td>
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<td>1987-1989</td>
<td>Alex Gillis</td>
<td>Halifax</td>
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<td>1991-1993</td>
<td>Sigmund H. Ein*</td>
<td>Toronto</td>
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<td>1993-1995</td>
<td>Angus Juckes</td>
<td>Regina</td>
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<td>1995-1997</td>
<td>Jean G. Desjardins</td>
<td>Montreal</td>
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<td>1997-1999</td>
<td>David P. Girvan</td>
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<td>1999-2001</td>
<td>Ray Postuma</td>
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<td>2001-2003</td>
<td>Mike Giacomantonio</td>
<td>Halifax</td>
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<td>2003-2005</td>
<td>Salam Yazbeck</td>
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<td>2005-2007</td>
<td>Nathan Wiseman</td>
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<td>2007-2009</td>
<td>Geoffrey Blair</td>
<td>Vancouver</td>
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<td>2009-2011</td>
<td>Jean-Martin Laberge</td>
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<td>2011-2014</td>
<td>Jacob Langer</td>
<td>Toronto</td>
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<td>2014-2016</td>
<td>Peter Fitzgerald</td>
<td>Hamilton</td>
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<tr>
<td>2016-2018</td>
<td>Erik Skarsgard</td>
<td>Vancouver</td>
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* deceased/ décédé
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<td>Salam Yazbeck</td>
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<td>2002-2006</td>
<td>Peter G. Fitzgerald</td>
<td>Hamilton</td>
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<tr>
<td>2006-2011</td>
<td>Juan Bass</td>
<td>Ottawa</td>
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<tr>
<td>2011-2017</td>
<td>BJ Hancock</td>
<td>Winnipeg</td>
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FOUNDING MEMBERS
MEMBRES FONDATEURS

ALLEN           Michael
ASHMORE*        Phillip
BEARDMORE*      Harvey
CAMERON         Gordon
COLLIN          Pierre-Paul
DESJARDINS      Jean G.
DUCHARME        Jacques C.
DUVAL*          Frederick
FALLIS          James
FERGUSON*       Colin
GILLIS          Alex
GUTTMAN         Frank M.
JUCKES          Angus
KARN*           Gordon
KENNEDY*        Richard
KLINAN*         Murray
KLING*          Samuel
MARSHALL*       Donald
MARSHALL*       Russell
MERCER*         Stanley
MURPHY*         David
OWEN*           Herbert
SHANDLING       Barry
SHRAGOVITCH*    Israël
SIMPSON*        James
STEPHENS*       Clinton
THOMSON*        Stuart
TURCOT*         Jacques
BURRINGTON      John
FRASER          Graham

* deceased / décédé

1st ANNUAL MEETING was held January 22, 1969 in VANCOUVER

Le premier CONGRÈS ANNUEL eut lieu le 22 janvier, 1969 à VANCOUVER
THE COAT OF ARMS OF
THE CANADIAN ASSOCIATION OF PAEDIATRIC SURGEONS

LES ARMOIRIES DE
L'ASSOCIATION CANADIENNE DE CHIRURGIE PÉDIATRIQUE
Herbal Blazon

Per pale gules and purpure, dexter a scalpel erect entwined by a serpent, sinster a child standing, all argent.

Crest: On the three maple leaves slipped gules and blacked purpure, the date 1967.
Motto: "Je le pensay, Dieu le guèrit".

Description
The red and purple of the arms are also the colours of the Royal College of Physicians and Surgeons of Canada and represent the blood met in surgery - arterial and venous. The scalpel with the healing serpent of Aesculapius, and the figure of a well child combine to symbolize the practice of Paediatric Surgery.

The crest is the Canadian maple leaf and the founding date of the Association (1967).

The Motto is a quotation from Ambroise Pare, a father of modern surgery. The sixteenth-century French translates, "I treated him, God cured him".

Le Blason

Au gauche, un bistouri droit entouré d'un serpent alors qu'à droite se tient un enfant, tout argent.

Au sommet se trouvent trois feuilles d'érable ainsi que la date 1967.
De devise: "Je le pensay, Dieu le guèrit".

Description
Le rouge et le violet des armoiries sont les couleurs du Collège Royal des Médecins et Chirurgiens du Canada et représentent le sang artériel et veineux vu au cours de la chirurgie. L'association du bistouri avec le serpent guérisseur d'Esculape ainsi qu'avec l'image d'un enfant en bonne santé symbolise la pratique de la chirurgie pédiatrique.

La couronne du blason est la feuille d'érable du Canada et la date de fondation de notre association (1967).

La devise est une citation d'Ambroise Parè, père de la chirurgie moderne.
Visiting Lecturers:

1969  Vancouver  Davenport/Segal
1970  Montreal  F. Wiglesworth
1971  Ottawa  A. Sass-Kortsak
1972  Toronto  MacIntyre
1973  Edmonton  L. Stern
1974  Montreal  J. Folkman

Fred MacLeod Lecturers:

1975  Winnipeg  D. J. Waterston
1976  Quebec City  D. Pellerin
1977  Toronto  F.D. Stephens
1978  Vancouver  J.H. Louw
1979  Montreal  O. Swenson
1980  Ottawa  D. Cohen
1981  Toronto  H.W. Clatworthy
1982  Quebec  P. Mollard
1983  Calgary  K. Kimura
1984  Montreal  M. M. Ravitch
1985  Vancouver  P. Jones
1986  Halifax  A. F. Schärli
1987  Winnipeg  S. L. Gans
1988  Ottawa  J. G. Raffensperger
1989  Edmonton  J.C. Molenaar
1990  St-John’s  K. D. Anderson
1991  Quebec City  J. L. Grosfeld
1992  Ottawa  A. G. Coran
1993  Victoria  K. W. Ashcraft
1995  Cheribourg Magog, Quebec  J. A. Tovar
1996  Halifax  N. P. Kenny
1997  Banff  R. Satava
1998  Toronto  R. Resnick
1999  Montreal  P. K. Donahoe
2000  Montebello  J. A. O’Neill, Jr
2001  9 / 11
2002  Vancouver  Birabwe-Male

JPS/Fred MacLeod Lecturers:

2003  Niagara-on-the –Lake  S. Adzick
2004  Winnipeg  K. Georgeson
2005  Quebec City  A. Al-Rabeeah
2006  Calgary
2007  St- John’s  C. J. H Stolar
2008  Toronto  Jose Boix-Ochoa
2009  Halifax  M. Gauderer
2010  Saskatoon  H. A. Heij
2011  Ottawa  Marcelo Martinez-Ferro
2012  Victoria  John M. Hutson
2013  Charlottetown  Keith Oldham
2014  Montréal  Ronald B. Hirschl
2015  Niagara Falls  Kevin P. Lally
2016  Vancouver  Shawn Rangel
The Canadian Association of Paediatric Surgeons
L’Association canadienne de chirurgie pédiatrique

is pleased to invite
est fière d’inviter

Dr. Shawn Rangel

To give the JPS / Fred MacLeod Annual Lecture.
À donner la conférence annuelle JPS/ Fred MacLeod:

‘Moving the needle’ toward high-quality surgical care:
How can we achieve this goal through prioritization, measurement
and more effective collaboration?

The visit by
La visite du

Dr. Shawn Rangel

is made possible with the financial support of
est rendue possible grâce à la générosité de
Shawn Jason Rangel, MD, MSCE
CAPS’ 2016 JPS / Fred MacLeod Lecturer

Dr. Shawn Rangel is Associate Professor, Harvard Medical School, Boston, Massachusetts. He trained in Pediatric Surgery at the Cincinnati Children’s Hospital & Medical Centre and completed a Masters of Science in Clinical Epidemiology at Stanford University, Palo Alto.

Dr. Rangel’s research areas of interest are in Surgical Quality Improvement and Patient Safety. He is a leader in the implementation of Pediatric NSQIP at Boston Children’s Hospital and serves as Director of Quality Improvement and Patient Safety, Department of Pediatric Surgery, Boston Children’s Hospital. He has been involved in the development and use of several quality improvement initiatives in his centre. He is a member of the American Pediatric Surgical Association (APSA) and serves as Chair of APSA’s Surgical Quality & Safety Committee. He is on the Executive Committee of the Children’s Surgery Verification Program, American College of Surgeons and serves as Chair of the ACS Pediatric NSQIP Executive Steering Committee. He has published extensively and is well renowned for his expertise in Quality Improvement and Patient Safety.

We are honoured to have Dr. Rangel participate in our 2016 CAPS Annual Meeting Program and look forward to his JPS / Fred MacLeod Lecture.
RESIDENTS’ OR MEDICAL STUDENTS’ PAPERS
A panel of members from the Publication Committee adjudicates the oral presentations presented by medical students or residents. A panel of members from the Program Committee adjudicates the posters presented by medical students or residents.

PRÉSENTATIONS DES RÉSIDENTS OU DES ÉTUDIANTS EN MÉDECINE
Les présentations orales faites par les étudiants ou les résidents sont jugées par un jury constitué des membres du comité de publication. Les présentations d’affiches faites par les étudiants ou les résidents sont jugées par un jury constitué des membres du comité de programme.

Trainee Prizes: CAPS 2015, Niagara Falls, Ontario, September 17-19, 2015

A. President’s Prize - Prix Du Président
For Outstanding Presentation by a Student- Pour La Meilleure Présentation Par Un(E) Étudiant(E)

Name: Victoria Sattarova (Supervisor: Dr. Agostino Pierro)
Paper Title: Laparoscopy in pediatric surgery: Implementation and supporting evidence
Institution: The Hospital for Sick Children (Toronto, Ontario)
Prize: Monetary award

B. Poster Prizes
First: David Coyle (Supervisor: Dr. Prem Puri)
Paper Title: Altered neurotransmitter expression profile in the ganglionic bowel in Hirschsprung’s disease
Institution: National Children’s Research Centre, (Dublin 12, Ireland)
Prize: 1-year subscription to Journal of Pediatric Surgery

Second: Patrice Eastwood (Supervisors: Drs. Richard Keijzer and Jan Deprest)
Paper Title: MicroRNA 200b is up-regulated in the fetal rabbit lung following the surgical creation of congenital diaphragmatic hernia
Institution: Katholieke Universiteit (Leuven, Belgium) / University of Manitoba / Manitoba Institute of Child Health (Winnipeg, Manitoba)
Prize: 1-year subscription to Seminars in Pediatric Surgery
C. Oral Presentations

Name: Michael Livingston (Supervisors: Dr. J Mark Walton)
*Paper Title*: Are some children with empyema at risk for treatment failure with fibrinolytics? A multicenter cohort study
*Institution*: McMaster University (Hamilton, Ontario)
*Prize*: 1-year subscription to *Journal of Pediatric Surgery*

Name: Patrick B. Murphy (Supervisor: Dr. Sarah Jones)
*Paper Title*: The increasing incidence of gallbladder disease in children: A 20 year perspective
*Institution*: University of Western Ontario (London, Ontario)
*Prize*: 1-year subscription to *Seminars in Pediatric Surgery*

Name: Fouad Youssef (Supervisor: Dr. Robert Baird)
*Paper Title*: Flap versus fascial closure for gastroschisis: A systematic review and meta-analysis
*Institution*: Montreal Children's Hospital (Montreal, Québec)
*Prize*: Pediatric Surgery textbook

D. Bilingualism Prize

Name: Dr. Natalia Dementieva (Supervisor: N/A)
*Paper Title*: Expérience dans le traitement des hémangiomes problématiques avec le propranolol et le laser diode 940nm; Our experience of treatment of problematic hemangiomas with propranolol and 940 nm diode laser
*Institution*: Dnipropetrovsk Regional Children’s Hospital (Dnipropetrovsk, Ukraine)
*Prize*: Monetary

E. Innovation Prize

Name: Naghmeh Khoshgoo (Supervisor: Dr. Richard Keijzer)
*Paper Title*: microRNA miR-200b is essential for normal lung development in CDH
*Institution*: Children’s Hospital Research Institute of Manitoba (Winnipeg, Manitoba)
*Prize*: Monetary
THE CANADIAN ASSOCIATION OF PAEDIATRIC SURGEONS WOULD LIKE TO ACKNOWLEDGE THE FINANCIAL SUPPORT OF THE FOLLOWING SPONSORS

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B.J. Hancock
Secretary-Treasurer
ABBREVIATIONS

O  oral presentation- présentation orale
R  resident paper- présentation par résident
C/T case/technique report- présentation de cas ou de technique
P  poster presentation- présentation d'affiche
O, R, P  Adjudicated- éligible pour les prix
C/T  Not adjudicated (except for bilingual effort)- non-éligible pour les prix (sauf pour le bilinguisme)
<table>
<thead>
<tr>
<th>Time</th>
<th>Session</th>
<th>Title</th>
<th>Speakers</th>
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<tbody>
<tr>
<td>12:15 - 12:25</td>
<td>OR 1</td>
<td>Natural history of prenatally diagnosed congenital lung lesions</td>
<td>Shetal Mehta(^1,2), Greg Ryan(^2), Gareth Seaward(^2), Rory Windrim(^2), Johannes Keunen(^2), Sharon Unger(^3), Karel O'Brien(^3), Jacob Langer(^1), Priscilla Chiu(^1)</td>
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<td>(^1)Division of General and Thoracic Surgery, The Hospital for Sick Children, Toronto, Ontario, Canada</td>
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<td>(^2)Fetal Medicine Unit, Department of Obstetrics and Gynecology, Mount Sinai Hospital, Toronto, Ontario, Canada</td>
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<td>(^3)Division of Neonatology, Mount Sinai Hospital, Toronto, Ontario, Canada</td>
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<td>12:25 - 12:35</td>
<td>OR 2</td>
<td>Follicatin-like 1 expression is decreased in alveolar epithelium of hypoplastic rat lung with nitrofen-induced congenital diaphragmatic hernia</td>
<td>Toshiaki Takahashi, Julia Zimmer, Florian Friedmacher, Prem Puri</td>
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<td>12:35 - 12:45</td>
<td>OR 3</td>
<td>Thoracoscopy vs. thoracotomy for the repair of esophageal atresia and tracheoesophageal fistula: a systematic review and meta-analysis</td>
<td>Colin Way(^1), Carolyn Wayne(^2), Brittany Jade Harrison(^1), Ahmed Nasr(^1,2)</td>
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<td>(^1)University of Ottawa, Ottawa, Ontario, Canada</td>
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<td>(^2)Children's Hospital of Eastern Ontario, Ottawa, Ontario, Canada</td>
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<td>12:45 - 12:55</td>
<td>O 4</td>
<td>Optimal age for elective surgery for asymptomatic congenital pulmonary airway malformations (CPAM): a systematic review</td>
<td>Katrina J Sullivan(^1), Michelle Li(^1), Sarah Haworth(^1), Elizabeth Chernetsova(^2), Jessica Kapralik(^3), Emily Chan(^1), Carolyn Wayne(^1), Ahmed Nasr(^1,3)</td>
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<td>(^1)Department of Pediatric Surgery, Children’s Hospital of Eastern Ontario, Ottawa, Ontario, Canada</td>
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| 12:55 | OR   | **Downregulation of KCNQ 5 expression in the rat pulmonary vasculature of nitrofen-induced congenital diaphragmatic hernia**  
Julia Zimmer¹, Toshiaki Takahashi¹, Alejandro Hofmann¹,², Prem Puri¹,³  
¹National Children’s Research Centre, Our Lady’s Children’s Hospital, Crumlin, Dublin, Ireland  
²Department of Paediatric Surgery, Hannover Medical School, Hannover, Germany  
³School of Medicine and Medical Science and Conway Institute of Biomedical Research, University College, Dublin, Ireland |
| 13:05 | OR   | **MicroRNA miR-10a and abnormal lung development in congenital diaphragmatic hernia**  
R Visser¹, C Fraser², D Mulhall³, F Zhu², C Day², B Iwasiow², T Mahood³, R Keijzer²,³  
¹Department of General Surgery, University of Manitoba, Winnipeg, Manitoba, Canada  
²Section of Pediatric Surgery, Department of Surgery and Children’s Hospital Research Institute of Manitoba, Winnipeg, Manitoba, Canada  
³Department of Physiology and Pathophysiology, University of Manitoba, Winnipeg, Manitoba, Canada |
| 13:15 | OR   | **CT-guided autologous blood tattoo: an innovative approach for thoracoscopic excision of nonpleural-based lung lesions in pediatric patients**  
Fariha Sheikh¹, Ryan Joseph Brandt⁴, Michael Tsapakos⁵, Eiman Anvari⁵, Daniel Croitoru¹  
¹Division of Pediatric Surgery, Department of Surgery, Hitchcock Medical Center, Lebanon, New Hampshire, USA  
³Department of Radiology, Dartmouth Hitchcock Medical Center, Lebanon, New Hampshire, USA |
| 13:25 | OR   | **Elastase and matrix metalloproteinase activity are associated with pulmonary vascular disease in the nitrofen rat model of congenital diaphragmatic hernia**  
Benjamin G Wild¹,², Stéphanie Langlois¹,³, Kyle N Cowan¹,²,³  
¹Molecular Biomedicine Program, Children’s Hospital of Eastern Ontario, Ottawa, Ontario, Canada  
²Department of Cellular and Molecular Medicine, University of Ottawa, Ottawa, Ontario, Canada  
³Division of Paediatric Surgery, Department of Surgery, Children’s Hospital of Eastern Ontario, University of Ottawa, Ottawa, Ontario, Canada |

**Special Presentation: “The History of CAPS on the Canadian West Coast”**  
Dr. Graham Fraser
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<th>Authors</th>
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<tr>
<td>14:30</td>
<td>P R</td>
<td>14:30 - 14:34</td>
<td>Predicting time to full enteral nutrition in infants with short bowel syndrome</td>
<td>Jessica Gonzalez-Hernandez¹, Purvi Prajapati¹, Gerald Ogola¹, Nandini Channabasappa¹, Barbara Drews², Hannah G Piper²</td>
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<td>¹Baylor University Medical Center, Dallas, Texas, USA</td>
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<td>²Children's Health/UT Southwestern, Dallas, Texas, USA</td>
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<td>14:35</td>
<td>P R</td>
<td>14:35 - 14:39</td>
<td>Antegrade continence enemas improve quality of life in patients with medically-refractory encopresis</td>
<td>Joseph T Church, Siddartha Simha, Daniel H Teitelbaum, Peter F Ehrlich</td>
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<td>Section of Pediatric Surgery, Department of Surgery, University of Michigan Health System, Ann Arbor, Michigan USA</td>
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<td>14:40</td>
<td>P</td>
<td>14:40 - 14:44</td>
<td>Incidence of Hirschsprung’s disease in Ontario: a population-based study using validated health administrative data</td>
<td>Katrina J Sullivan¹, Eric Benchimol², Coralie Wong⁴, Ahmed Nasr¹,³</td>
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<td>¹Department of Pediatric Surgery, Children’s Hospital of Eastern Ontario, Ottawa, Ontario, Canada</td>
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<td>²Division of Gastroenterology, Hepatology and Nutrition, Children’s Hospital of Eastern Ontario, Ottawa, Ontario, Canada</td>
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<td>⁴Ottawa Hospital Research Institute, Ottawa, Ontario, Canada</td>
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<td>14:45</td>
<td>P R</td>
<td>14:45 - 14:49</td>
<td>Using morphometric modeling to assess preoperative risk in children with thoracic insufficiency syndrome</td>
<td>Wayne G Sun¹,², Brianna C Henderson¹,², Brian A Derstine¹, Calista M Harbaugh¹,², Frances A Farley³, Michelle Burke³, Michelle S Caird³, Ronald B Hirschl³, Peter F Ehrlich¹,²</td>
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<td>¹Morphomic Analysis Group, University of Michigan Medical School, Ann Arbor, Michigan, USA</td>
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<td>²Section of Pediatric Surgery, Department of Surgery, University of Michigan Medical School and C.S. Mott Children’s Hospital, Ann Arbor, Michigan, USA</td>
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<td>³Department of Orthopedic Surgery, The University of Michigan Medical School, Ann Arbor, Michigan, USA</td>
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<td>13</td>
<td>P R</td>
<td>14:50 - 14:54</td>
<td><strong>Use of renal NIRS measurements on congenital diaphragmatic hernia patients on ECMO</strong></td>
<td>Patricio E Lau1,2, Stephanie Cruz1,2, Joseph Garcia-Prats3, Milenka Cuevas3, Christopher Rhee3, Darrell L Cass1,2,3, Sarah E Horne2, Timothy C Lee1,2, Stephen E Welty1,3, Oluyinka O Olutoye1,2,3,4</td>
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<td>1Texas Children’s Fetal Center, Houston, Texas, USA</td>
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<td>2Michael E. DeBakey Department of Surgery Baylor College of Medicine, Houston, Texas, USA</td>
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<td>3Baylor College of Medicine Department of Pediatrics, Houston, Texas, USA</td>
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<td>4Baylor College of Medicine Department of Obstetrics and Gynecology, Houston, Texas, USA</td>
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<td>14</td>
<td>P R</td>
<td>14:55 – 14:59</td>
<td><strong>Gastrojejunostomy tube complications – a single centre experience and systematic review</strong></td>
<td>James Morse1, Robert Baird1, Karl Muchantef2, Dominique Levesque3, Veronique Morinville3, Pramod S. Puligandla1</td>
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<td>2Pediatric Interventional Radiology</td>
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<td>3Pediatric Gastroenterology</td>
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<td>McGill University Health Centre, Montreal, Quebec, Canada</td>
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<td>15</td>
<td>P</td>
<td>15:00 - 15:04</td>
<td><strong>Persistence of hepatic fibrosis in paediatric intestinal failure patients treated with intravenous fish oil emulsions</strong></td>
<td>Christina Kosar1, Rory Thompson2, Gino Somers2, Nicole de Silva1, Kevin Fitzgerald1, Karen Steinberg1, Glenda Courtney-Martin1, Paul W Wales1,3, Yaron Avitzur1,4</td>
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<td>1Group for Improvement of Intestinal Function and Treatment</td>
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<td>2Division of Pediatric Laboratory Medicine</td>
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<td>The Hospital for Sick Children, Toronto, Ontario, Canada</td>
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<td>16</td>
<td>P R</td>
<td>15:05 - 15:09</td>
<td><strong>Atropine as an alternative to re-pyloromyotomy in infants with recurrent pyloric stenosis</strong></td>
<td>Augusto Zani, Elke Zani-Ruttenstock, Jacob C Langer, Agostino Pierro</td>
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<td>17</td>
<td>P R</td>
<td>15:10 - 15:14</td>
<td><strong>Corrected to uncorrected? The metabolic conundrum of hypertrophic pyloric stenosis</strong></td>
<td>Sowmith Rangu, Victoriya Chernyavsky, Natalie L Yanchar</td>
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<td>Department of Surgery, Dalhousie University, Halifax, Nova Scotia, Canada</td>
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</table>
| 15:15 - 16:35 | Scientific Session #2 Oral Presentations: Foregut/Hindgut/Appendicitis
Moderators: Charles Bagwell, Jacob Langer |
|-------------|------------------------------------------------------------------|
| 18 O R | 15:15 - 15:25 | Comparing pyloromyotomy outcomes across Canada  
Alexander C Ednie\(^1\), Natalie L Yancha\(^{1,2}\)  
\(^1\)Department of Surgery, Dalhousie University, Halifax, Nova Scotia, Canada  
\(^2\)IWK Health Centre, Halifax, Nova Scotia, Canada |
| 19 O R | 15:25 - 15:35 | Pleurectomy versus pleurodesis for primary spontaneous pneumothorax in children  
Shahrzad Joharifard\(^1\), Brian A Coakley\(^2\), Sonia A Butterworth\(^2\)  
\(^1\)Division of General Surgery, University of British Columbia, Vancouver, British Columbia, Canada  
\(^2\)Division of Pediatric Surgery, British Columbia Children's Hospital, University of British Columbia, Vancouver, British Columbia, Canada |
| 20 O R | 15:35 - 15:45 | Do x-rays after chest tube removal change patient management?  
Bret Johnson\(^1\), Michele Rylander\(^2\), Alana L Beres\(^{1,2}\)  
\(^1\)University of Texas Southwestern, Department of General Surgery, Dallas, Texas, USA  
\(^2\)Children's Health, Division of Pediatric Surgery, Dallas, Texas, USA |
| 21 O R | 15:45 – 15:55 | NOSIP, a modulator of nitric oxide production is increased in the colon of patients with Hirschsprung disease  
Christian Tomuschat\(^1\), Anne Marie O'Donnell\(^1\), David Coyle\(^1\), Nickolas Dreher\(^1\), Prem Puri\(^{1,2}\)  
\(^1\)National Children's Research Centre, Our Lady's Children's Hospital, Crumlin, Dublin, Ireland  
\(^2\)School of Medicine and Medical Science and Conway Institute Biomedical Research, University College Dublin, Ireland |
| 22 O R | 15:55 - 16:05 | Loop versus divided colostomy for the management of anorectal malformations: a systematic review and meta-analysis  
Fouad Youssef, Ghaida arbash, Pramod Puliandla, Robert Baird  
Division of Pediatric General and Thoracic Surgery, McGill University Health Centre, Montreal, Quebec, Canada |
| 23 O R | 16:05 - 16:15 | Cost analysis of non-operative management of acute appendicitis in children  
Martina Mudri\(^1\), Andreana Büttler\(^{1,2}\)  
\(^1\)Schulich School of Medicine and Dentistry, Western University, Division of General Surgery, London Health Sciences Centre, London, Ontario  
\(^2\)Division of Pediatric Surgery, Children's Hospital, London Health Sciences Centre, London, Ontario, Canada |
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<tr>
<td>24</td>
<td>OR</td>
<td>16:15 - 16:25</td>
<td>Cost transparency of laparoscopic appendectomy- decreasing operating room margins while maintaining quality</td>
<td>Min Suk Han¹, Nicole E Sharp¹, Carla J Newton¹, Lena Z Perger², Kelly D Mattix², Monford D Custer², Danny C Little²</td>
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<td>¹Baylor Scott &amp; White Memorial Hospital, Temple, Texas, USA</td>
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<td>²McLane Children's Scott &amp; White Hospital, Temple, Texas, USA</td>
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<td>25</td>
<td>OR</td>
<td>16:25 - 16:35</td>
<td>Glycerin suppositories used prophylactically in premature infants (SUPP): a pilot study for a multicenter randomized controlled trial</td>
<td>Michael H Livingston¹²⁷, Henrietta Blinder¹, Connie Williams³⁴, Sarah A Jones⁵, Peter L Rosenbaum⁴⁶, J Mark Walton¹⁶</td>
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<td>¹McMaster Pediatric Surgery Research Collaborative, McMaster University</td>
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<td>⁸Western University, London, Ontario, Canada</td>
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16:40 – 17:00 **CAPSNet/CBAR update**  
E Skarsgard, P Puligandla, J M Laberge

18:30 - 23:00 **Welcome Reception- Vancouver Rowing Club**

**FRIDAY, SEPTEMBER 23, 2016**

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<tr>
<td>08:00 - 09:30</td>
<td>O R</td>
<td>08:00 - 08:10</td>
<td>Long-term outcomes of newborns with necrotizing enterocolitis: a retrospective matched cohort study</td>
<td>A Shah¹, M Mrdutt², E Sanders¹, L Mallett², J Pruszynski², L Perger²</td>
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<td>¹Division of Pediatric Surgery, McLane Children's Hospital, Texas A&amp;M University, Temple, Texas, USA</td>
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<td>²Baylor Scott and White Health, Temple, Texas, USA</td>
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| 27  | O    | 08:10 - 08:20 | A comparison of Broviac and peripherally inserted central catheters in children with intestinal failure           | Jennifer Styers¹, Carolina Blotte², Hong Zhu³, Nandini Chanabasappa⁴, Hannah G Piper¹                | ¹Division of Pediatric Surgery, University of Texas, Southwestern/Children's Health, Dallas, Texas, USA  
²Texas Tech University Health Science Center, Lubbock, Texas, USA  
³Division of Biostatistics, University of Texas Southwestern, Dallas, Texas, USA  
⁴Division of Gastroenterology, University of Texas, Southwestern/Children's Health, Dallas, Texas, USA |
| 28  | O    | 08:20 - 08:30 | Two year follow-up of children with surgically and conservatively treated necrotizing enterocolitis                  | U Rolle¹, R Dewitz², S Bakthiar³, R Schloesser³, A Allendorf³                                       | ¹Department of Pediatric Surgery and Pediatric Urology  
²Department of Pediatric Neurology  
³Department of Neonatology                                                                                       |
| 29  | O R  | 08:30 - 08:40 | Intestinal epithelial cell viability is increased by the addition of breast milk-derived exosomes                  | Alison Hock¹,², Hiromu Miyake¹,², Carol Lee², Leonardo Ermini², Bo Li², Yuhki Koike¹, Yong Chen¹, Augusto Zani¹, Agostino Pierro¹,² | ¹Division of General and Thoracic Surgery  
²Physiology and Experimental Medicine Program                                                                 |
| 30  | O R  | 08:40 - 08:50 | Predictors of intestinal adaptation in paediatric intestinal failure (IF): a retrospective cohort study              | Kevin Fitzgerald¹, Christina Kosar¹, Nicole de Silva¹, Yaron Avitzur², Karen Steinberg¹, Paul W Wales¹,², Glenda Courtney-Martin¹ | ¹Group for Improvement of Intestinal Function and Treatment (GIFT)  
²Division of Gastroenterology, Hepatology and Nutrition  
³Division of General and Thoracic Surgery                                                                |
| 31  | O R  | 08:50 - 09:00 | Poor gastric emptying correlates to the severity of intestinal damage in experimental NEC                              | Yuhki Koike¹,²,³, Bo Li¹, Carol Lee¹, Shigang Cheng¹, Hiromu Miyake¹, Alison Hock¹, Augusto Zani¹,², Agostino Pierro¹,² | ¹Physiology and Experimental Medicine Program, The Hospital for Sick Children, Toronto, Ontario, Canada  
²Division of General and Thoracic Surgery, The Hospital for Sick Children, Toronto, Ontario, Canada  
³Department of Gastrointestinal and Pediatric Surgery, Mie Graduate School of Medicine, Tsu, Mie, Japan |
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<tr>
<th>Time</th>
<th>Session/Activity</th>
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<tr>
<td>09:00 - 09:10</td>
<td><strong>Endoplasmic reticulum stress in intestinal epithelium during necrotizing enterocolitis</strong></td>
<td>Bo Li, Carol Lee, Qi Li, Yuhki Koike, Shigang Chen, Augusto Zani, Agostino Pierro. Division of General and Thoracic Surgery, Physiology and Experimental Medicine Program, The Hospital for Sick Children, Toronto, Ontario Canada</td>
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</tbody>
</table>
| 09:10 - 09:20 | **Microbiome analysis in experimental necrotizing enterocolitis** | Yuhki Koike1,3, Pekka Maattanen2, Bo Li1, Carol Lee1, Hiromu Miyake1, Alison Hock1, Augusto Zani1, Philip M Sherman2, Agostino Pierro1.  
1Division of General and Thoracic Surgery, Physiology Experimental Medicine Program, The Hospital for Sick Children, Toronto, Ontario, Canada  
2Cell Biology Program, Research Institute, Division of Gastroenterology, Hepatology and Nutrition, The Hospital for Sick Children, University of Toronto, Toronto, Ontario, Canada  
3Department of Gastrointestinal and Pediatric Surgery, Mie University Graduate School of Medicine, Tsu, Mie, Japan |
| 9:30 - 10:00 | **Coffee Break** |                                                                                                                                          |
| 10:00 - 11:00 | **JPS/MacLeod Lecture: Dr. Shawn Rangel** | “Moving the needle” toward high-quality surgical care: How can we achieve this goal through prioritization, measurement and more effective collaboration? **Learning Objectives**  
At the completion of the activity, participants will:  
1. Understand the dimensions of quality as defined by the Institute of Medicine, and how these dimensions can be used as a framework for categorizing quality deficiencies in the delivery of pediatric surgical care.  
2. Be able to cite the procedures in pediatric surgery that are associated with the greatest relative burden of morbidity, mortality, & resource utilization, and how these data can be leveraged as a prioritization framework for future QI efforts.  
3. Be able to describe the evolution of the American College of Surgeon’s National Surgical Quality Improvement Program from a registry of adverse events to a comprehensive comparative performance platform for pediatric surgical quality.  
4. Be able to describe how collaborative knowledge-sharing networks can be leveraged to accelerate quality improvement by identifying and disseminating best practices from high-performing hospitals. |

The Ethics Session will present scenarios and engage the CAPS audience with interactive questions to set off the debate sessions. Participants will be asked to use the audience response system to provide pre-debate and post-debate answers to the MCQ’s provided for each scenario.

**Learning Objectives**

At the completion of this activity, participants will:
1. Understand the proposed standards and regionalization of care for pediatric surgical centers.
2. Be able to cite studies on the relationship of surgical volume and experience and the impact it can have on patient outcomes.
3. Understand the potential for anticipated and unanticipated risks to the patient with introduction of new technology or techniques.
4. Understand limits of assuring proficiency when performing a new technique.
5. Understand the surgeon’s professional and personal responsibilities for providing safe patient care.
6. Be familiar with measures and procedures to facilitate and aid surgeon well-being.

**CAPS Ethics Session and 2nd Annual Ein Debate**

**Moderator:** Peter Fitzgerald

**Ethics in patient care: quality and safety issues in “every day” pediatric surgery**

**Video/Technique Session**

**Moderators:** Alana Beres, Rodrigo Romao

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<tr>
<th>13:00 - 13:45</th>
<th><strong>The role of adjunctive procedures in reducing postoperative tracheobronchial obstruction in single lung patients with congenital tracheal stenosis undergoing slide tracheoplasty</strong></th>
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<td>34 T</td>
<td>13:00 - 13:07</td>
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<td>34 T R</td>
<td>13:07 - 13:14</td>
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**Peroral endoscopic myotomy in a large cohort of children: safety and efficacy mid-term results**

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**Lunch box pick up**

12:45-13:00
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<tr>
<td>13:14</td>
<td>T R</td>
<td>Use of bedside abdominal ultrasound to confirm intestinal motility in neonates with gastroschisis: a feasibility study</td>
<td>Lori A Gurien¹, Deidre L Wyrick¹, Steven C Mehl¹, Melvin S Dassinger¹, Marie E Saylors², Samuel D Smith¹</td>
<td>Arkansas Children's Hospital, Department of Pediatric Surgery; Arkansas Children's Hospital Research Institute, Department of Biostatistics; Arkansas Children's Hospital, Little Rock, Arkansas, USA</td>
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<tr>
<td>13:21</td>
<td>V R</td>
<td>The laparoscopic ovary-sparing excision of a benign teratomas</td>
<td>Arul Thirumoorthi, Howard Kao, Joanne Baerg</td>
<td>Loma Linda University Children's Hospital, Loma Linda, California, USA</td>
</tr>
<tr>
<td>13:28</td>
<td>T R</td>
<td>Titanium plate fixation of flail chest in pediatric blunt trauma: long-term outcomes for two cases</td>
<td>Muhammad Nadeem¹, Hibbut-ur-Rauf Naseem², William F. Stendardi³, Kathryn D. Bass²</td>
<td>Department of Surgery, SUNY at Buffalo, New York, USA; Department of Pediatric Surgery, Women and Children's Hospital of Buffalo, Buffalo, New York, USA; Jacobs School of Medicine and Biomedical Sciences, SUNY at Buffalo, Buffalo, New York, USA</td>
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<tr>
<td>13:35</td>
<td>T R</td>
<td>Potential pitfalls of laparoscopic inguinal hernia repair in children: report of an unrecognized sliding hernia and other rare complications</td>
<td>Amanda Maas, Shant Shekherdimian</td>
<td>Division of Pediatric Surgery, Ronald Reagan UCLA Medical Center, University of California Los Angeles, Los Angeles, California, USA</td>
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13:45 – 14:15 Coffee break
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<td>40</td>
<td>O R</td>
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<td><strong>Combination trophic peptide therapy for neonatal short bowel syndrome</strong></td>
<td>David W Lim¹, Crystal L Lévesque², Donna F Vine³, Mitsuru Muto⁴, Jacob R Koepke⁵, Patrick N Nation⁶, P Wizzard⁷, Julang Li⁸, David L Bigam¹, Patricia L Brubaker⁹, Justine M Turner⁴, Paul W Wales⁸,¹⁰</td>
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<td>41</td>
<td>O</td>
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<td><strong>Outcome prediction in gastroschisis: the gastroschisis prognostic score (GPS) revisited</strong></td>
<td>P S Puligandla¹, R Baird¹, E D Skarsgard², S Emil¹, J-M Laberge¹ and the Canadian Pediatric Surgery Network</td>
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<td>42</td>
<td>O R</td>
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<td><strong>Determinants of outcomes in patients with simple gastroschisis</strong></td>
<td>Fouad Youssef, Jean-Martin Laberge, Pramod Puligandla, Sherif Emil, The Canadian Pediatric Surgery Network</td>
</tr>
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</table>

¹ Department of Surgery, South Dakota State University, Brookings, South Dakota, USA  
² Department of Animal Science, South Dakota State University, Brookings, South Dakota, USA  
³ Department of Agricultural, Food and Nutritional Science, University of Alberta, Edmonton, Alberta, Canada  
⁴ Department of Pediatrics, University of Alberta, Edmonton, Alberta, Canada  
⁵ Department of Laboratory Medicine and Pathology, University of Alberta, Edmonton, Alberta, Canada  
⁶ Department of Animal and Poultry Science, University of Guelph, Guelph, Ontario, Canada  
⁷ Department of Surgery, University of Calgary, Calgary, Alberta, Canada  
⁸ Departments of Physiology and Medicine, University of Toronto, Toronto, Ontario, Canada  
⁹ Department of Surgery, University of Toronto, Toronto, Ontario, Canada  
¹⁰ Department of Surgery and Group for the Improvement of Intestinal Function and Treatment, The Hospital for Sick Children, Toronto, Ontario, Canada
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<tr>
<td>14:45</td>
<td>O R</td>
<td><strong>Perioperative determinants of transient hypocalcemia after pediatric total thyroidectomy</strong></td>
<td>Yangyang R Yu¹, Sara C Fallon¹, Jennifer L Carpenter¹, Ioanna D Athanassaki², Mary L Brandt¹, David E Wesson¹, Monica E Lopez¹</td>
<td>¹Division of Pediatric Surgery, Department of Surgery, Texas Children’s Hospital, Houston, Texas, USA ²Department of Diabetes and Endocrinology, Texas Children’s Hospital, Houston, Texas, USA</td>
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<tr>
<td>14:55</td>
<td>O</td>
<td><strong>Safety and dosing of glucagon-like peptide 2 (GLP-2) in infants</strong></td>
<td>David Sigalet¹, Mary Brindle³, Dana Boctor², Bryan Dicken³, Viona Lam³, Lu Lily Sia¹, Elaine de Heuvel¹, Bolette Hartmann⁴, Jens Holst⁴</td>
<td>¹Pediatric Surgery, Alberta Children’s Hospital, University of Calgary, Calgary, Alberta, Canada ²Pediatric Gastroenterology, Alberta Children’s Hospital, University of Calgary, Calgary, Alberta, Canada ³Surgery (Pediatric), Stollery Children’s Hospital/University of Alberta, Edmonton, Alberta, Canada ⁴NNF Center for Basic Metabolic Research, Department of Biomedical Sciences, University of Copenhagen, Copenhagen, Denmark</td>
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<tr>
<td>15:05</td>
<td>O</td>
<td><strong>The use of balloon dilation in post-operative strictures in children with short bowel syndrome</strong></td>
<td>Christina Kosar¹, Kevin Fitzgerald¹, Nicole de Silva¹, Karen Steinberg¹, Yaron Avitzur¹,², Paul W Wales¹,³</td>
<td>¹Group for Improvement of Intestinal Function and Treatment (GIFT) ²Division of Gastroenterology, Hepatology and Nutrition ³Division of General and Thoracic Surgery The Hospital for Sick Children, Toronto, Ontario, Canada</td>
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<tr>
<td>15:15</td>
<td>O R</td>
<td><strong>Beyond traditional growth charts: a more granular understanding of pediatric growth through analytic morphomics</strong></td>
<td>Calista M Harbaugh¹,³, Peng Zhang³, Brianna Henderson¹,³, Brian Derstine⁵, Sven A Holcombe⁶, Stewart C Wang²,³, Carla Kohoyda-Inglis⁴, Peter F Ehrlich¹,³</td>
<td>¹Section of Pediatric Surgery, Department of Surgery, The University of Michigan Medical School and The C.S. Mott Children’s Hospital, Ann Arbor, Michigan, USA ²Section of Trauma Burn Surgery, Department of Surgery, The University of Michigan Medical School, Ann Arbor, Michigan, USA ³Morphomic Analysis Group, The University of Michigan Medical School, Ann Arbor, Michigan, USA</td>
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| 47 | O | 15:25 - 15:35 | **AVATAR: applying vacuum to accomplish reduced wound infections in laparoscopic pediatric surgery**

R Visser¹, K Milbrandt², S Lum Min², N Wiseman², BJ Hancock², M Morris², R Keijzer²

¹Department of General Surgery, University of Manitoba, Winnipeg, Manitoba, Canada
²Section of Pediatric Surgery, Department of Surgery and Children’s Hospital Research Institute of Manitoba, University of Manitoba, Winnipeg, Manitoba, Canada

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| 15:45 - 16:00 |   |   | Update from the CAPS Research Committee

The CAPS Research Committee will provide the audience with updates on the CAPS research grant and clinical trials currently open for pediatric surgeon participation.

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| 16:00 - 16:30 |   |   | CAPS President’s Address

Peter Fitzgerald - TBA

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**SATURDAY, SEPTEMBER 24, 2016**

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| 09:00 - 10:30 | Scientific Session #5 Oral Presentations: Innovation/Best Practices Moderators: Roshni Dasgupta, Andrew Zigman

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| 48 | O R | 09:00 - 09:10 | **Less rigorous brace protocol for pectus carinatum**

George Wahba, Marcos Bettolli, Ahmed Nasr

Children's Hospital of Eastern Ontario, University of Ottawa, Ottawa, Ontario, Canada

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| 49 | O R | 09:10 - 09:20 | **Atropine treatment for hypertrophic pyloric stenosis: a systematic review and meta-analysis**

Giuseppe Lauriti¹², Valentina Cascini², Pierluigi Lelli Chiesa², Agostino Pierro¹, Augusto Zani¹

¹Division of General and Thoracic Surgery, The Hospital for Sick Children, Toronto, Ontario, Canada
²Pediatric Surgery Department, "Spirito Santo" Hospital, Pescara, Italy

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| 50 | O R | 09:20 - 09:30 | **Improving access and value for families: the pediatric surgery telehealth program**

Paige Dean¹, Lenny Zhou¹³, Maureen O’Donnell²⁴, Erik Skarsgard¹

¹Department of Surgery, BC Children's Hospital, Vancouver, British Columbia, Canada
²Department of Pediatrics, BC Children's Hospital, Vancouver, British Columbia, Canada
³Office of Pediatric Surgical Evaluation and Innovation, Vancouver, British Columbia, Canada
⁴Child Health BC, Vancouver, British Columbia, Canada
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<th>Speaker(s)</th>
<th>Location(s)</th>
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| 09:30  | OR      | **Evaluation of a checklist for the improvement of informed consent process in pediatric surgery**  
Mohammed Firdouse, Amy Walchendler, Martin Koyle, Annie Fectue  
Faculty of Medicine, University of Toronto, Toronto, Ontario, Canada  
York University, Toronto, Ontario, Canada  
Division of Urology, The Hospital for Sick Children, Toronto, Ontario, Canada  
Division of General and Thoracic Surgery, The Hospital for Sick Children, Toronto, Ontario, Canada  
Division of Urology, The Hospital for Sick Children, Toronto, Ontario, Canada  
Division of General and Thoracic Surgery, The Hospital for Sick Children, Toronto, Ontario, Canada  
Division of Urology, The Hospital for Sick Children, Toronto, Ontario, Canada  
Division of General and Thoracic Surgery, The Hospital for Sick Children, Toronto, Ontario, Canada  |
| 09:40  | OR      | **Pyloromyotomy: is it safe to do after 3 pm?**  
Phylicia Dupree, Inna N Lobeck, Monir Hossain, Anna Varughese, Roshni Dasgupta  
Pediatric General and Thoracic Surgery  
Division of Biostatistics and Epidemiology  
Department of Anesthesia,  
Cincinnati Children's Hospital, Cincinnati, Ohio, USA  |
| 09:50  | O       | **Variability of surgical technique for children with biliary atresia in Canada: is it time for standardization?**  
B H Cameron, N L Yanchar, S Emil, J-M Laberge, N Ahmed, G Anthopoulos, A Butler, C Jimenez-Rivera, S R Martin, R A Schreiber, and the Canadian Biliary Atresia Registry  
McMaster Children's Hospital, Hamilton Ontario, Canada  
IWK Health Centre, Halifax, Nova Scotia, Canada  
Montreal Children's Hospital, Montreal, Quebec, Canada  
B.C. Children's Hospital, Vancouver, British Columbia, Canada  
Children's Hospital of Eastern Ontario, Ottawa Ontario, Canada  
Alberta Children's Hospital, Calgary, Alberta, Canada  |
| 10:00  | O       | **Barriers and facilitators to the implementation of evidence-based practice by pediatric surgeons**  
Katrina J Sullivan, Carolyn Wayne, Andrea Patey, Ahmed Nasr  
Department of Pediatric Surgery, Children's Hospital of Eastern Ontario, Ottawa, Ontario, Canada  
City University, London, United Kingdom  
Ottawa Hospital Research Institute, University of Ottawa, Ottawa, Ontario, Canada  
Faculty of Medicine, University of Ottawa, Ottawa, Ontario, Canada  |
| 10:10  | OR      | **Practice patterns in the reduction of paediatric intussusception in Canada**  
Dylan Stephanian, Mohammadali Khorasani, Douglas H Jamieson, James J Murphy  
B.C. Children's Hospital, Vancouver, British Columbia, Canada  |
<p>| 10:30  |        | <strong>Coffee break</strong>                                                          |                                                                                                |</p>
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<tr>
<td>11:00 - 12:00</td>
<td>56</td>
<td><strong>Decreased radiographic utilization in dedicated pediatric trauma centers</strong></td>
<td>Nicole E Sharp¹, Laura Harmon¹, Nicholas C Pugh¹, Danny C Little², Justin L Regner³</td>
<td>Baylor Scott &amp; White Memorial Hospital, Temple, Texas, USA</td>
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<td>McLane Children's Scott &amp; White Hospital, Temple, Texas, USA</td>
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<td>11:05 - 11:09</td>
<td>57</td>
<td><strong>Pediatric surgical workforce and training in Africa: current status and future needs</strong></td>
<td>Asra Toobaie¹, Sherif Emil², Doruk Ozgediz³, Sanjay Krishnaswami⁴, Dan Poenaru⁵</td>
<td>McGill University, Montreal, Quebec, Canada</td>
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<td>Montreal Children's Hospital, Montreal, Quebec, Canada</td>
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<td>Yale University, New Haven, Connecticut, USA</td>
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<td>OHSU Pediatric Surgery, Portland, Oregon, USA</td>
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<td>11:10 - 11:14</td>
<td>58</td>
<td><strong>Does conception using assisted reproductive technologies (ART) increase the risk of congenital malformations in the offspring after adjusting for subfertility? A systematic review</strong></td>
<td>Gregory Knapp¹, Stefan Kuhle², Jonathan Melong¹, Victoria Allen⁴, Rodrigo Romao¹</td>
<td>Division of Pediatric Surgery, Dalhousie University</td>
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<td>Perinatal Epidemiology Group, Dalhousie University</td>
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<td>Department of Obstetrics and Gynaecology, Dalhousie University</td>
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<td>11:15 - 11:19</td>
<td>59</td>
<td><strong>The surgical management of intestinal malrotation: a Canadian Association of Paediatric Surgeons survey</strong></td>
<td>Ceilidh Kinlin¹, Anna C. Shawyer²</td>
<td>Cumming School of Medicine, University of Calgary, Calgary, Alberta, Canada</td>
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<td>Alberta Children's Hospital, University of Calgary, Calgary, Alberta, Canada</td>
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<td>11:20 - 11:24</td>
<td>60</td>
<td><strong>Why so late? Barriers to timely access to pediatric surgical care at Mbarara Regional Referral Hospital, Uganda</strong></td>
<td>Mercedes Pilkington¹, Martin Situma², Andrea Winthrop¹, Dan Poenaru³</td>
<td>Department of Surgery, Queen's University, Kingston, Ontario, Canada</td>
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<td>Mbarara University Teaching Hospital, Mbarara University for Science and Technology, Mbarara, Uganda</td>
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| 61   | PR   | 11:25 - 11:29 | High prevalence of same-sex twins in patients with cloacal exstrophy: support for embryological association with monozygotic twinning | Brenna S Fullerton<sup>1,2</sup>, Eric A Sparks<sup>1,2</sup>, Amber M Hall<sup>1</sup>, Cristine S Velasco<sup>1,2</sup>, Biren P Modi<sup>1,2</sup>, Dennis P Lund<sup>3</sup>, Tom Jaksic<sup>1,2</sup>, W Hardy Hendren<sup>1</sup> | <sup>1</sup>Department of Surgery, Boston Children’s Hospital, Boston, Massachusetts, USA  
<sup>2</sup>Center for Advanced Intestinal Rehabilitation, Boston Children’s Hospital, Boston, Massachusetts, USA  
<sup>3</sup>Stanford University Department of Surgery and Lucile Packard Children’s Hospital, Palo Alto, California, USA |
| 62   | PR   | 11:30 - 11:34 | A mixed-methods review of pediatric surgical safety checklists                                                                          | Janaka Lagoo<sup>1</sup>, Alex Haynes<sup>1</sup>, Steven Lopushinsky<sup>2</sup>, Erik Skarsgard<sup>3</sup>, Helene Flageole<sup>4</sup>, Lizabeth Edmondson<sup>1</sup>, Mary Brindle<sup>1,2</sup> | <sup>1</sup>Ariadne Labs at Brigham and Women’s Hospital, Harvard T.H. Chan School of Public Health, Boston, Massachusetts, USA  
<sup>2</sup>Alberta Children’s Hospital, University of Calgary, Calgary, Alberta, Canada  
<sup>3</sup>British Columbia Children’s Hospital, University of British Columbia, Vancouver, British Columbia, USA  
<sup>4</sup>McMaster Children’s Hospital, McMaster University, Hamilton, Ontario, Canada |
| 63   | PR   | 11:35 - 11:39 | Prenatal diagnosis and outcome of fetal gastrointestinal obstructions                                                                     | Patricio E Lau<sup>1,2</sup>, Stephanie Cruz<sup>1,2</sup>, Christopher I Cassady<sup>3</sup>, Amy R Mehollin-Ray<sup>4</sup>, Rodrigo Ruano<sup>1,4</sup>, Sundeep Keswani<sup>1,2,4</sup>, Timothy C Lee<sup>1,2</sup>, Oluyinka O Olutoye<sup>1,2,3,4</sup>, Darrell L Cass<sup>1,2,3,4</sup> | <sup>1</sup>Texas Children’s Fetal Center  
<sup>2</sup>Baylor College of Medicine Department of Surgery  
<sup>3</sup>Baylor College of Medicine Department of Radiology  
<sup>4</sup>Baylor College of Medicine Department of Obstetrics and Gynecology  
Baylor College of Medicine, Houston, Texas, USA |
| 64   | PR   | 11:40 - 11:44 | Hepatic hemangiomas: infantile or congenital – how do you know?                                                                           | Miho Watanabe, Carol Chute, Adrienne Hammill, Arnold Merrow, Belinda Dickie, Roshni Dasgupta        | Hemangioma and Vascular Malformations Team, Cincinnati Children’s Hospital Medical Center, Cincinnati, Ohio, USA |
| 65   | P    | 11:45 - 11:49 | The distribution of gastoschisis in Manitoba                                                                                             | Melanie Morris<sup>1</sup>, Leah Brezinski<sup>1</sup>, Chelsea Ruth<sup>2</sup>, Micheal Narvey<sup>2</sup> | <sup>1</sup>Department of Pediatric Surgery, University of Manitoba  
<sup>2</sup>Department of Neonatology  
University of Manitoba, Winnipeg, Manitoba, Canada |
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<tr>
<td>12:00 - 12:15</td>
<td><strong>Lunch Box pick up</strong></td>
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| 12:15 - 13:15  | **CAPS Educational Session: “Difficult Case Conference and Lunch with Experts”**  
                | **Moderators: Andrea Winthrop, Steve Lopushinsky**                  |
|                | The Education Session will present challenging clinical cases for their panel of trainees and “experts” to discuss, including diagnostic work up, case management dilemmas and treatment options. The expert panel will weigh in on the discussion to provide additional insights. Audience participation will be requested using the audience response system. |
| 13:15 - 14:45  | **Scientific Session #6 Oral Presentations: Trauma/Oncology/Global Surgery**  
                | **Moderators: Ted Gerstle, Dan Little**                           |
| 66 O R        | 13:15 - 13:25 | **Cervical spine imaging for young children with inflicted trauma: expanding the injury pattern** |
|               |               | Arul Thirumoorthi, Rosemary Vannix, Asma Taha, Alex Zouros, Amy Young, Joanne Baerg |
|               |               | Loma Linda University Children's Hospital, Loma Linda, California, USA |
|               |               | Oluwatomilayo Daodu¹, Carlos R Alvarez-Allende¹,², Lisette Lockyer², Bryce Weber¹,², Mary Brindle¹,², Steven R Lopushinsky¹,² |
|               |               | ¹Department of Surgery, Cumming School of Medicine, University of Calgary, Calgary, Alberta, Canada  
               | ²Section of Pediatric Surgery, Alberta Children's Hospital, Calgary, Alberta, Canada |
| 68 O          | 13:35 - 13:45 | **Tunneled central venous catheter in children with malignant disease: comparison of open to percutaneous implantation** |
|               |               | U Rolle¹, L Blum¹, U Abdel-Rahman¹, T Klingebiel², S Gfroerer¹ |
|               |               | ¹Department of Pediatric Surgery and Pediatric Urology  
               | ²Department of Pediatric Oncology |
|               |               | University Hospital, Goethe-University Frankfurt/M., Germany |
|               |               | Michael Livingston¹,², Kamary Coriolano¹,³, Sarah Jones¹,² |
|               |               | ¹London Health Science Centre, London, Ontario, Canada  
               | ²University of Western Ontario, London, Ontario, Canada |
## Injury severity in pediatric all-terrain vehicle related trauma in Nova Scotia

Samuel Jessula, Nadia Murphy, Natalie Yanchar

Dalhousie University, Department of Pediatric Surgery, Halifax, Nova Scotia, Canada

### Compliance with evidence-based guidelines for computed tomography of children with head and abdominal trauma

Ihab Halaweish, Jane Riebe-Rodgers, Amy Randall, Peter Ehrlich

Section of Pediatric Surgery, Department of Surgery, University of Michigan, Ann Arbor, Michigan, USA

### Pannexin1 regulates the malignant properties of rhabdomyosarcoma: novel therapeutic implications

Xiao Xiang¹,², Marie-Eve St-Pierre¹, Stéphanie Langlois¹,³, Jessica Barré¹, Tammy Le Pham¹,², Kyle N Cowan¹,²,³

¹Molecular Biomedicine Program, Children’s Hospital of Eastern Ontario, Ottawa, Ontario, Canada
²Department of Cellular and Molecular Medicine, University of Ottawa, Ottawa, Ontario, Canada
³Division of Paediatric Surgery, Department of Surgery, Children’s Hospital of Eastern Ontario, University of Ottawa, Ottawa, Ontario, Canada

### Exploring a new paradigm for global pediatric surgery training

Geoffrey Blair¹, Sonia Butterworth¹, John Sekabira², Phyllis Kisa²

¹Division of Pediatric Surgery, University of British Columbia, Vancouver, British Columbia, Canada
²Department of Surgery, Makerere University, Kampala, Uganda

## CAPS Global Partnership Session

### Introductions: Geoff Blair, Andrea Winthrop

<table>
<thead>
<tr>
<th>Time</th>
<th>Event</th>
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<tr>
<td>14:45 - 15:15</td>
<td>CAPS Travelling Resident Presentation</td>
<td>Kartik Pandya</td>
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<tr>
<td>15:15 - 15:30</td>
<td>President’s Closing Remarks</td>
<td>Peter Fitzgerald</td>
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<th>Time</th>
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<tr>
<td>15:45 - 16:00</td>
<td>Poster take down/clear poster hall</td>
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<tr>
<td>18:30 - 24:00</td>
<td>Presidential Reception and Banquet</td>
<td>Westin Bayshore Hotel</td>
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</table>
Natural history of prenatally diagnosed congenital lung lesions

Shetal Mehta¹,², Greg Ryan ², Gareth Seaward ², Rory Windrim ², Johannes Keunen ², Sharon Unger ², Karel O’Brien ², Jacob Langer ¹, Priscilla Chiu ¹

¹ The Hospital for Sick Children, Toronto, Ontario, Canada
² Mount Sinai Hospital, Toronto, Ontario, Canada

Purpose: To study the clinical course of prenatally diagnosed lung lesions and correlate with postnatal outcomes.

Methods: Retrospective study (1996-2014) of prenatally diagnosed lung lesions and their postnatal follow up were reviewed.

Results: Of 229 pregnancies diagnosed with fetal lung lesions, there were 3 pregnancy terminations, 2 spontaneous abortions and 2 fetal demises. One hundred and fifty were followed postnatally and detailed. Median gestational age (GA) at diagnosis was 21 weeks. 13/150 (9%) lesions increased in size and all underwent fetal interventions, 12 thoracoamniotic shunting and 1 open fetal surgery. Median GA at intervention was 24.6 weeks. In contrast, 30/150 (20%) lesions were stable and 87 (58%) decreased in size, of which 43 (29%) resolved completely on prenatal ultrasound by 33.9 weeks (median). All prenatally treated cases required emergency neonatal surgery; none of the cases that resolved on prenatal ultrasound did. There were 139 term deliveries, 11 preterm (<37 weeks) (5/11 after shunt). In all, 99 (66%) children underwent surgery, 51 (34%) were managed expectantly. Of the 99, 26 were resected for symptomatic neonates (<1 month of age), 73 resected electively (median age 7 months). Only 6/73 (8%) children undergoing elective resection had respiratory infections before surgery. Median follow-up for expectantly managed children was 20 months (5 months-10 years), of whom only 3 (6%) had pneumonia. Pleuro-pulmonary blastoma was not reported.

Conclusion: Congenital lung lesions that increase in size prenatally are high risk, requiring close monitoring pre- and post-natally. Those that “resolve” on prenatal ultrasound, usually persist postnatally, but do not pose a major health threat to infants. Expectant management of asymptomatic cases is a valid treatment option.

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Follistatin-like 1 expression is decreased in the alveolar epithelium of hypoplastic rat lungs with nitrofen-induced congenital diaphragmatic hernia

Toshiaki Takahashi, Julia Zimmer, Florian Friedmacher, Prem Puri

National Children's Research Centre, Our Lady's Children's Hospital, Crumlin, Dublin, Ireland

Purpose: Pulmonary hypoplasia (PH), characterized by incomplete alveolar development, remains a major therapeutic challenge associated with congenital diaphragmatic hernia (CDH). Follistatin-like 1 (Fstl1) is a crucial regulator of alveolar formation and maturation, which is strongly expressed in distal airway epithelium. Fstl1-deficient mice exhibit reduced airspaces, impaired alveolar epithelial cell differentiation and insufficient production of surfactant proteins similar to PH in human CDH. We hypothesized that pulmonary Fstl1 expression is decreased during alveolarization in the nitrofen-induced CDH model.

Methods: Following ethical approval (REC668b), timed-pregnant rats received nitrofen or vehicle on gestational day 9 (D9). Fetal lungs were harvested on D18 and D21, and divided into control-/nitrofen-exposed specimens (n=12/time-point and group). Alveolarization was assessed using morphometric analysis techniques. Pulmonary gene expression of Fstl1 was determined by qRT-PCR. Immunofluorescence-double-staining for Fstl1 and alveolar epithelial marker surfactant protein C (SP-C) was performed to evaluate protein expression/localization.

Results: Radial alveolar count was significantly reduced in hypoplastic lungs of nitrofen-exposed fetuses (Figure 1a) with significant downregulation of Fstl1 mRNA expression on D18 (2.88±0.74 vs. 3.42±0.27; P<0.05) and D21 (1.82±0.59 vs. 2.30±0.73; P<0.05) compared to controls. Confocal-laser-scanning-microscopy revealed strikingly diminished Fstl1 immunofluorescence and SP-C expression in distal alveolar epithelium of nitrofen-exposed fetuses with CDH-associated PH on D18 and D21 compared to controls (Figure 1b).

Conclusion: Decreased expression of Fstl1 in alveolar epithelium may disrupt alveolarization and pulmonary surfactant production, thus contributing to the development of PH in nitrofen-induced CDH.
### Morphometric Analysis

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<thead>
<tr>
<th></th>
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<th>Nitrofen</th>
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<tr>
<td><strong>D18</strong></td>
<td><img src="image" alt="H&amp;E" /></td>
<td><img src="image" alt="H&amp;E" /></td>
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<td><img src="image" alt="Bar Graph" /></td>
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Control Nitrofen
*P<0.0001
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### Immunofluorescence

<table>
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<tr>
<th></th>
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<tr>
<td><strong>D18</strong></td>
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Control Nitrofen
*P<0.0001
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Thoracoscopy vs. thoracotomy for the repair of esophageal atresia and tracheoesophageal fistula: a systematic review and meta-analysis

Colin Way¹, Carolyn Wayne², Brittany Jade Harrison¹, Ahmed Nasr¹,²

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²Children’s Hospital of Eastern Ontario, Ottawa, Ontario, Canada

Purpose: The role of thoracoscopy for esophageal atresia and tracheoesophageal fistula is unclear. We compared intra- and post-operative outcomes of thoracotomy and thoracoscopy using systematic review and meta-analysis.

Methods: We conducted electronic searches of CENTRAL, MEDLINE, and EMBASE and hand-searched the reference sections of included articles. We undertook dual, independent screening and quality assessment, conducted meta-analyses when possible, and otherwise summarized results narratively.

Results: We identified three systematic reviews, one randomized controlled trial, eight non-randomized comparative studies, and 20 non-randomized non-comparative studies. The systematic reviews were of low quality and inconclusive. From our own meta-analyses, we found no differences between procedures in rates of anastomotic leak (OR 1.09, [0.45, 2.59], p=0.85), esophageal stricture (OR 0.85, [0.30, 2.44], p=0.77), or reflux (OR 0.77, [0.24, 2.44], p=0.66). The operative time for thoracoscopy was longer than for thoracotomy in three studies, but shorter in one (MD 24.94, [-15.00, 64.89], p=0.22). Results also showed fewer days to extubation, shorter length of narcotic use, and shorter time to full feeds following thoracoscopy, variable differences in length of hospital stay, minimal blood loss with both methods, and rates of fistula recurrence at 0/50 after thoracoscopy and 3/61 after thoracotomy. Most studies found no differences in arterial blood gas measurements intra- or post-operatively. Conversion from thoracoscopy to open occurred in 8.4% of cases.

Conclusion: Thoracoscopic approach for repair of esophageal atresia and tracheoesophageal fistula appears to be safe, with no statistically significant differences in morbidity when compared with an open approach.

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Optimal age for elective surgery for asymptomatic congenital pulmonary airway malformations (CPAM): a systematic review

Katrina J Sullivan 1, Michelle Li 1, Sarah Haworth 1, Elizabeth Chernetsova 2, Jessica Kapralik 2, Emily Chan 1, Carolyn Wayne 1, Ahmed Nasr 1,3

1 Department of Pediatric Surgery, Children’s Hospital of Eastern Ontario, Ottawa, Ontario, Canada
2 Department of Pathology and Laboratory Medicine, University of Ottawa, Ottawa, Ontario, Canada
3 Faculty of Medicine, University of Ottawa, Ottawa, Ontario, Canada

Purpose: To determine the optimal age for elective surgical resection of asymptomatic congenital pulmonary airway malformations (CPAM).

Methods: A systematic search of Embase, MEDLINE, CINAHL, and CENTRAL was conducted in January 2016. Identified citations were screened independently in duplicate and the methodological quality of included studies was evaluated. Data were extracted on study, patient, and intervention characteristics, as well as clinical outcomes. Results were pooled using inverse variance fixed effects meta-analysis.

Results: Thirteen studies evaluated the effect of age at surgery on clinical outcomes of a total of 225 patients. Meta-analysis of complications did not favour any one age group in a statistically significant manner (Figure 1). Additional meta-analyses were possible for two secondary outcomes: length of hospital stay was statistically shorter for patients ≥3 months of age (mean difference (MD) 4.13, 95% confidence intervals (CI) 2.31-5.96, p<0.00001) and ≥6 months of age at resection (MD 3.38, 95% CI 0.44-6.31, p=0.02); length of pleural drainage was statistically shorter for patients ≥6 months of age at resection (MD 1.06, 95% CI 0.02-2.09, p=0.05). No mortalities were reported at any operative age.

Conclusion: Meta-analysis results do not clearly favour any one age for elective resection of asymptomatic CPAM. Postponing surgery until at least the third month of life is associated with a decreased length of hospital stay.

<table>
<thead>
<tr>
<th>Subgroup</th>
<th>Number of studies</th>
<th>Odds Ratio 95% CI</th>
<th>I²</th>
<th>P value</th>
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</thead>
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<tr>
<td>≤1 month vs. &gt;1 month</td>
<td>2</td>
<td>1.1 (0.13, 9.61)</td>
<td>0</td>
<td>0.93</td>
</tr>
<tr>
<td>&lt;3 months vs. ≥3 months</td>
<td>2</td>
<td>4.2 (0.78, 22.77)</td>
<td>0</td>
<td>0.10</td>
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<tr>
<td>&lt;6 months vs. ≥6 months</td>
<td>3</td>
<td>2.39 (0.63, 9.11)</td>
<td>0</td>
<td>0.20</td>
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Figure 1: Meta-analysis of complications experienced by patients who underwent elective resection of asymptomatic CPAM at various ages
Downregulation of KCNQ 5 expression in the rat pulmonary vasculature of nitrofen-induced congenital diaphragmatic hernia

Julia Zimmer ¹, Toshiaki Takahashi ¹, Alejandro D. Hofmann ¹,³, Prem Puri ¹,²

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² School of Medicine and Medical Science and Conway Institute of Biomedical Research, University College, Dublin, Ireland
³ Department of Paediatric Surgery, Hannover Medical School, Hannover, Germany

Purpose: Pulmonary hypertension (PH) is a common complication of congenital diaphragmatic hernia (CDH). KCNQs channels are essential for regulating the pulmonary vascular tone and are downregulated in models of hypertension. KCNQ1, KCNQ4 and KCNQ5 are expressed by pulmonary artery smooth muscle cells, contributing to their resting membrane potential. We hypothesised that KCNQ1, KCNQ4 and KCNQ5 expression is downregulated in the pulmonary vasculature of nitrofen-induced CDH rats.

Methods: After ethical approval (REC913b), time-pregnant rats received nitrofen or vehicle on gestational day (D) 9. D21 fetuses were divided into CDH (n=11) and control group (n=11). QRT-PCR and western blotting were performed to determine gene and protein expression of KCNQ1, KCNQ4 and KCNQ5. Confocal microscopy was used to detect these proteins in the pulmonary vasculature.

Results: Relative mRNA level of KCNQ5 (p=0.025) was significantly downregulated in CDH lungs compared to controls (Figure1). KCNQ1 (p=0.052) and KCNQ4 (p=0.574) expression was not altered. Western blotting confirmed the decreased pulmonary KCNQ5 protein expression in CDH lungs. Confocal-microscopy detected a markedly diminished KCNQ5 expression in pulmonary vasculature of CDH fetuses compared to controls.

Conclusion: Downregulated pulmonary expression of KCNQ5 in CDH lungs suggests that this potassium channel may play an important role in the development of PH in this model. The KCNQ5 channel may be a potential therapeutic target for the treatment of PH in CDH.
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MicroRNA miR-10a and abnormal lung development in congenital diaphragmatic hernia

R Visser 1, C Fraser 2, D Mulhall 2, F Zhu 2, C Day 2, B Iwasiow 2, T Mahood 2,3, R Keijzer 2,3

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2 Department of Pediatric Surgery and Child Health and Children’s Hospital Research Institute of Manitoba, University of Manitoba, Winnipeg, Manitoba, Canada
3 Department of Physiology and Pathophysiology, University of Manitoba, Winnipeg, Manitoba, Canada

Purpose: We have previously identified microRNA miR-10a to be upregulated in human hypoplastic CDH lungs after birth. We hypothesized that miR-10a expression is disturbed during lung development in the nitrofen rat model of CDH. In this study we aimed to define the role of miR-10a in both normal and abnormal lung development.

Methods: We obtained approval from our animal ethics review board and used the nitrofen rat model of CDH, and used real-time quantitative polymerase chain reaction (RT-qPCR) and fluorescent in situ hybridization to study quantitative and qualitative miR-10a expression during lung development. We then used miR-10a mimics and inhibitors to perform loss- and gain-of function studies in an embryonic lung explant model.

Results: miR-10a expression was reduced in early nitrofen-induced abnormal lung development. We observed most expression in the lung mesenchyme, but concentration of miR-10a expression in nitrofen-induced abnormal lung epithelium towards term. Nitrofen-induced hypoplastic lung branching in the lung explant model could be reversed by increasing miR-10a expression using mimics.

Conclusion: We observed lower miR-10a expression in early nitrofen-induced abnormal lung development. Normalizing this expression in our lung explant model improved nitrofen-induced abnormal lung development. We will explore these potential beneficial effects of prenatal microRNA therapy in future studies.

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CT-guided autologous blood tattoo: an innovative approach for thoracoscopic excision of nonpleural-based lung lesions in pediatric patients

Fariha Sheikh¹, Ryan Joseph Brandt², Michael Tsapakos², Eiman Anvari², Daniel Croitoru¹

¹ Department of Surgery, Division of Pediatric Surgery, Dartmouth Hitchcock Medical Center, Lebanon, New Hampshire, USA
² Department of Radiology, Division of Pediatric Surgery, Dartmouth Hitchcock Medical Center, Lebanon, New Hampshire, USA

Purpose: To describe a single-institutional experience with an innovative technique using CT-guided injection using autologous blood for localization of pulmonary nodules prior to thoracoscopic excisional biopsy in pediatric patients.

Methods: IRB approval was obtained to retrospectively review all patients under the age of 18 with lung lesions suspected to be malignant that were not pleural-based and were not of adequate size to visualize at thoracoscopy, who underwent CT-guided blood tattoo (CGBT) localization between 2006-2016. CGBT was performed under general anesthesia by injecting 5ml to 10ml of autologous blood into the area of the lesions in question. The patients were then immediately transferred from interventional radiology to the operating room for thoracoscopic excision of the lesion. Patient data regarding demographics, location of the lesion, indication for biopsy, pathology and incidence of complications were reviewed.

Results: In six pediatric patients (ages ranging from 4-18 years), preoperative CGBT localization of pulmonary nodules resulted in successful thoracoscopic excisional biopsy. All resections were diagnostic and 83% (5/6 cases) represented a metastatic malignancy as confirmed by pathologic analysis. Malignant nodules ranged from 4 to 9mm in size and a 13mm nodule excised in a patient with a history of AML was determined to represent an organizing pneumonia. One patient who underwent a failed attempt at excisional biopsy without preoperative localization then underwent CGBT one week later followed by successful thoracoscopic excision of the nodule.

Conclusion: CT-guided blood tattoo may be a safe option for localization of lung nodules prior to thoracoscopic excision in pediatric patients.

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Elastase and matrix metalloproteinase activity are associated with pulmonary vascular disease in the nitrofen rat model of congenital diaphragmatic hernia

Benjamin G Wild \textsuperscript{1,2}, Stéphanie Langlois \textsuperscript{1,3}, Kyle N Cowan \textsuperscript{1,2,3}

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\textsuperscript{2}Department of Cellular and Molecular Medicine, University of Ottawa, Ottawa, Ontario, Canada
\textsuperscript{3}Division of Paediatric Surgery, Department of Surgery, Children’s Hospital of Eastern Ontario, University of Ottawa, Ottawa, Ontario, Canada

Purpose: Pulmonary vascular disease (PVD) is a leading cause of congenital diaphragmatic hernia (CDH) mortality. Progression of PVD is caused by extracellular matrix remodeling by elastases and matrix metalloproteinases (MMP), concomitant with proliferation of smooth muscle cells (SMC) in a growth factor-enriched environment. Blockade of this pathway reversed primary pulmonary hypertension and improved survival. This study was designed to determine whether a similar pathway is induced in PVD secondary to CDH.

Methods: With IACUC approval, fetal rats exposed to nitrofen at gestational day 9 developed left-sided CDH and were compared at term to their non-CDH littermates and assessed for histologic and biochemical features of PVD (n=7 for each assessment). Statistical significance between groups (p<0.05) was determined using ANOVA followed by Tukey post-hoc analysis.

Results: Rats with CDH displayed lung hypoplasia, right ventricle hypertrophy, increased pulmonary artery medial wall thickness and muscularization, and decreased lumen size. This was associated with an increase in proliferation (proliferating chain nuclear antigen positivity) and a decrease in apoptosis (active caspase-3 positivity) of pulmonary artery SMCs. In situ zymography and immunohistochemistry revealed an increase in elastolytic and MMP activities, as well as epidermal growth factor and osteopontin levels, in the diseased vasculature.

Conclusion: We conclude that congenital diaphragmatic hernia-associated pulmonary vascular disease involves increased proliferation and decreased apoptosis of pulmonary artery smooth muscle cells, together with an induction of elastase and matrix metalloproteinase activity. Inhibition of this pathway may thus represent a novel therapeutic approach for the treatment of congenital diaphragmatic hernia-associated pulmonary vascular disease.

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Predicting time to full enteral nutrition in infants with short bowel syndrome

Jessica Gonzalez-Hernandez 1, Purvi Prajapati 1, Gerald Ogola 1, Nandini Channabasappa 2, Barbara Drews 2, Hannah G Piper 2

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2 Children's Health / UT Southwestern, Dallas, Texas, USA

Purpose: Parenteral nutrition (PN) contributes to significant morbidity in infants with short bowel syndrome (SBS). This study evaluates the utility of clinical variables in predicting time to independence from PN.

Methods: After IRB approval, a retrospective review of 69 infants with SBS requiring PN for > 6 weeks (2000-2013) was performed after excluding patients who remained on PN at study end. Clinical characteristics were evaluated by linear regression analysis to determine the relationship to time to full enteral nutrition. P-values < 0.05 were significant.

Results: The majority of infants had necrotizing enterocolitis (51%), gastroschisis (18%), or intestinal atresia (18%) with a median small bowel length of 54 cm (IQR, 35-91cm). The duration of PN was independent of gestational age (GA), etiology of SBS, presence of the ileocecal valve or colon, or location of anastomosis, but was strongly associated with small bowel length (p<0.01) and percent of expected small bowel based on GA (median 46%, p<0.01). Time to full enteral feeds can be estimated as seen in Table 1.

Conclusion: We conclude that many factors influence the duration of parenteral nutrition. However, this study found that infants with short bowel syndrome and < 50% of predicted small bowel length at diagnosis remained on parenteral nutrition for less than 2 years compared to approximately 1 year for those with 51-75%.

Table 1: Predicted time to full enteral nutrition based on remaining intestinal length

<table>
<thead>
<tr>
<th>% of expected small bowel length based on GA *</th>
<th>Time to full enteral nutrition (days, n = 69)</th>
</tr>
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<tbody>
<tr>
<td>≤ 25</td>
<td>873.1 (472.4-1273.9)</td>
</tr>
<tr>
<td>26 - 50</td>
<td>770.6 (612.5-928.6)</td>
</tr>
<tr>
<td>51 - 75</td>
<td>341.7 (311.5-371.9)</td>
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<tr>
<td>≥ 76</td>
<td>127.6 (107.1-148.1)</td>
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</table>

GA = gestational age
* All values are displayed as mean (95% CI)

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Antegrade continence enemas improve quality of life in patients with medically-refractory encopresis

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Purpose: Fecal incontinence is a socially-debilitating problem faced by many children. We hypothesized that, in patients with medically-refractory encopresis and no underlying congenital anomaly such as anorectal malformation or Hirschsprung disease, placement of an appendicostomy or cecostomy tube for administration of antegrade continence enemas (ACE) would improve quality of life (QOL).

Methods: We identified all patients with encopresis who underwent an ACE procedure between 2003 and 2014 at our institution and gathered data by retrospective chart review. We then contacted subjects’ parents by phone and administered three surveys: a clinical survey reflecting current stooling habits, a disease-specific QOL survey, and the PedsQLTM QOL survey. The QOL surveys were completed twice, once reflecting QOL prior to the operation by recall, then again reflecting current QOL. Pre-procedure and post-procedure QOL scores were compared by paired t-test.

Results: Ten patients underwent an ACE procedure for encopresis. Eight were able to be contacted by phone for survey administration. All procedures were performed laparoscopically. General and disease-specific QOL improved from pre-procedure to post-procedure in the following domains: social habits, physical activity, ability to spend the night elsewhere, feeling, and overall QOL (p < 0.05). PedsQLTM scores improved significantly in physical functioning, social functioning, and overall functioning (p < 0.05).

Conclusion: ACE can significantly improve QOL in patients with medically-refractory encopresis.

Table: PedsQL Pre- and Post-ACE

<table>
<thead>
<tr>
<th>PedsQL™</th>
<th>Pre-procedure</th>
<th>Post-procedure</th>
<th>p-value</th>
</tr>
</thead>
<tbody>
<tr>
<td>Physical</td>
<td>50.0 ± 32.9</td>
<td>82.4 ± 17.6</td>
<td>0.006 *</td>
</tr>
<tr>
<td>Emotional</td>
<td>58.1 ± 25.2</td>
<td>73.8 ± 25.6</td>
<td>0.056</td>
</tr>
<tr>
<td>Social</td>
<td>58.1 ± 29.5</td>
<td>78.8 ± 34.0</td>
<td>0.023 *</td>
</tr>
<tr>
<td>School</td>
<td>45.0 ± 21.9</td>
<td>70.6 ± 24.0</td>
<td>0.062</td>
</tr>
<tr>
<td>Overall</td>
<td>52.4 ± 22.7</td>
<td>77.2 ± 19.8</td>
<td>0.005 *</td>
</tr>
</tbody>
</table>

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Incidence of Hirschsprung’s disease in Ontario: a population-based study using validated health administrative data

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Purpose: To use Ontario’s population-based health administrative data to describe trends in incidence of Hirschsprung’s disease (HD) between 1991 and 2013.

Methods: Algorithms developed to identify children with HD were designed using a combination of diagnostic, procedural, and intervention codes and were validated using reference standards abstracted from chart review of a tertiary pediatric hospital. The algorithm with the highest positive predictive value (PPV) that was able to maintain high sensitivity was applied to health administrative data from April 31, 1991 to March 31, 2014 to determine annual incidence of HD. Temporal trends were evaluated using Poisson regression.

Results: The selected algorithm was highly sensitive (93.5%) and specific (>99.9%) with excellent predictive abilities (PPV 89.6%, NPV >99.9%). Using the algorithm, a total of 679 patients diagnosed with HD were identified in Ontario between 1991 and 2013 (see Table 1 for patient characteristics). Annual incidence rates ranged from 0.98-3.08/10,000 live births. Controlling for sex, the incidence rate ratio per 10,000 live births was 0.998 (95% confidence interval: 0.983-1.013, P=0.8) indicating no significant change in incidence over time.

Conclusion: Validated algorithms can be used to accurately identify cases of Hirschsprung’s disease from within health administration data. There has not been a significant change in incidence over time in Ontario between 1991 and 2013.
<table>
<thead>
<tr>
<th>Characteristic</th>
<th>N (%)</th>
</tr>
</thead>
<tbody>
<tr>
<td><strong>Sex</strong></td>
<td></td>
</tr>
<tr>
<td>Male</td>
<td>512 (75.41)</td>
</tr>
<tr>
<td>Female</td>
<td>167 (24.59)</td>
</tr>
<tr>
<td><strong>Age at diagnosis (years)</strong></td>
<td></td>
</tr>
<tr>
<td>0</td>
<td>613 (90.28)</td>
</tr>
<tr>
<td>1</td>
<td>29 (4.27)</td>
</tr>
<tr>
<td>2</td>
<td>17 (2.5)</td>
</tr>
<tr>
<td>3</td>
<td>6 (0.88)</td>
</tr>
<tr>
<td>4+</td>
<td>14 (2.06)</td>
</tr>
<tr>
<td><strong>Household at diagnosis</strong></td>
<td></td>
</tr>
<tr>
<td>Rural</td>
<td>86 (12.7)</td>
</tr>
<tr>
<td>Urban</td>
<td>589 (86.8)</td>
</tr>
<tr>
<td>Missing</td>
<td>4 (0.59)</td>
</tr>
<tr>
<td><strong>Rectal suction biopsies per patient</strong></td>
<td></td>
</tr>
<tr>
<td>0</td>
<td>140 (20.62)</td>
</tr>
<tr>
<td>1</td>
<td>444 (65.39)</td>
</tr>
<tr>
<td>2</td>
<td>77 (11.34)</td>
</tr>
<tr>
<td>3</td>
<td>11 (1.62)</td>
</tr>
<tr>
<td>4+</td>
<td>7 (1.03)</td>
</tr>
<tr>
<td><strong>Intervention</strong></td>
<td></td>
</tr>
<tr>
<td>No surgery (biopsy only)</td>
<td>86 (12.67)</td>
</tr>
<tr>
<td>Soave</td>
<td>100 (14.73)</td>
</tr>
<tr>
<td>Duhamel</td>
<td>88 (12.96)</td>
</tr>
<tr>
<td>Other</td>
<td>405 (59.65)</td>
</tr>
</tbody>
</table>

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Using morphometric modeling to assess preoperative risk in children with thoracic insufficiency syndrome

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Purpose: Children with Thoracic Insufficiency Syndrome (TIS) treated using a vertical expandable prosthetic titanium rib (VEPTR) have a high risk of postsurgical complications. Risk stratification tools are needed to better predict which children will benefit from this procedure. We sought to define morphometric characteristics of children with TIS compared to age and gender matched controls and to identify which characteristics can be used to predict adverse surgical outcomes.

Methods: Preoperative CT scans of 37 patients with TIS treated with VEPTR underwent morphometric analysis. Retrospective chart review was performed for the following variables: 30-day reoperation, wound infection, VEPTR failure, neurological symptoms, post-operative pneumonia, UTI, and long term pain. Univariate screening analysis using Spearman’s and Pearson’s correlation was performed to identify correlations between morphometric variables and complications.

Results: Compared to controls, TIS patients have lower high-density dorsal muscle group volume, higher low-density dorsal muscle group volume and higher visceral fat. Twenty-six out of thirty-two patients analyzed had one or more complications. Right lung eccentricity, defined as the ratio between the rostrocaudal and anteroposterior axes, was associated with decreased 30 day OR return (r=-0.551, p=.003), VEPTR failure (r=-0.515, p=0.0064), and wound infection (r=-0.552, p=0.0035).

Conclusion: TIS patients have more visceral fat and more fatty infiltrate of core muscle compared to controls. Lower rates of early reoperation, VEPTR failure, and wound infections were seen among children with higher lung eccentricity. This may be measurable preoperative characteristic that can be used to identify which children may benefit most from this potentially morbid procedure.

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Use of renal NIRS measurements on congenital diaphragmatic hernia patients on ECMO

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Purpose: The purpose of the study is to determine the utility of renal tissue oxygenation using Near Infrared Spectroscopy (rNIRS) as a surrogate for renal perfusion, and thus urine output, in congenital diaphragmatic hernia (CDH) patients that required extracorporeal membrane oxygenation (ECMO).

Methods: Neonates with CDH who required ECMO therapy and NIRS monitoring from 2012 to 2015 were reviewed. Continuous renal NIRS measurements, mean arterial pressure (MAP) and urine output data were extracted. Periods of anuria (NU), adequate urine output >1ml/kg/hr (AU), and low urine output <1ml/kg/hr (LU) where no interventions were performed were isolated and analyzed.

Results: Over 1,500 hours of continuous rNIRS were obtained from six neonates that had complete data. The average rNIRS value during AU was significantly higher than during periods of anuria or oliguria (Table 1). ROC curve showed rNIRS of 76% was highly predictive of adequate urine output. MAP was significantly lower during periods of anuria but similar in periods of low and adequate urine output. Serum lactate also correlated with urine output.

Conclusion: NIRS measurement of renal tissue oxygenation correlates with urine production. Lower rNIRS values are noted as urine output declines and precedes a decline in MAP. Renal NIRS may be a suitable non-invasive means of determining adequacy of renal perfusion and attendant changes in urine output in neonates with complex fluid shifts.

Table 1

<table>
<thead>
<tr>
<th></th>
<th>Appropriate Urine Output (AU)</th>
<th>Low Urine Output (LU)</th>
<th>No Urine Output (NU)</th>
<th>p-value</th>
</tr>
</thead>
<tbody>
<tr>
<td>rNIRS</td>
<td>83.93 +/- 6.26</td>
<td>76.12 +/- 2.98</td>
<td>67.18 +/- 6.40</td>
<td>&lt;0.001</td>
</tr>
<tr>
<td>MAP</td>
<td>42.99 +/- 5.25</td>
<td>42.85 +/- 7.40</td>
<td>36.42 +/- 10.26</td>
<td>&lt;0.001</td>
</tr>
<tr>
<td>BUN</td>
<td>41.52 +/- 23.96</td>
<td>43.5 +/- 7.78</td>
<td>37.1 +/- 23.32</td>
<td>0.864</td>
</tr>
<tr>
<td>Creatinine</td>
<td>0.59 +/- 0.21</td>
<td>0.805 +/- 0.13</td>
<td>0.86 +/- 0.28</td>
<td>0.007</td>
</tr>
<tr>
<td>pH</td>
<td>7.30 +/- 0.09</td>
<td>7.28 +/- 0.07</td>
<td>7.29 +/- 0.07</td>
<td>0.512</td>
</tr>
<tr>
<td>Lactate</td>
<td>1.74 +/- 0.93</td>
<td>1.28 +/- 0.56</td>
<td>3.77 +/- 2.47</td>
<td>&lt;0.001</td>
</tr>
</tbody>
</table>
Gastrojejunostomy tube complications – a single centre experience and systematic review

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Purpose: Gastrojejunostomy tubes (GJTs) enable enteral nutrition in infants/children with gastric feeding intolerance but complications may be increased in young infants. We evaluated our single-institution GJT complication rate and systematically reviewed existing literature.

Methods: With IRB approval, a retrospective single-institution analysis of all GJT placements between 2009 and 2015 was performed. Data was collected regarding demographics and major/minor complications. A systematic assessment of available literature was conducted following MOOSE guidelines.

Results: Forty-eight children underwent 160 GJT insertion attempts; 158 were successful. Most frequent indications included GER (n=27; 55%) and aspiration (n=11; 23%). Median age and weight at insertion were 2.2 years (0.2-18) and 10.7 kg (3.0-47), respectively. Twenty-one (44%) had an index GJT insertion <6 months. The median GJT lifespan was 98 days (0-661 days). Age <6 months had no impact on GJT lifespan (p=0.95). 113 GJTs (72%) were removed or replaced due to complications (Figure 1). Major complications included perforation (n=3; 1.9%), causing 1 mortality, and intussusception (n=2; 1.3%). All perforations occurred in infants <6 months (3/27; 11%). In appraising 26 related articles (1 prospective) totaling 1318 patients, perforation occurred almost exclusively in children <10kg (17/18; 95%), resulting in 4 deaths (24%).

Conclusion: Gastrojejunostomy tubes are associated with significant complications and frequently require revision/replacement. Insertion in patients <10kg is associated with increased perforation risk. Alternate feeding access should be employed in this population.
Persistence of hepatic fibrosis in paediatric intestinal failure patients treated with intravenous fish oil emulsions

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Purpose: Intestinal failure associated liver disease (IFALD) is a life-threatening complication experienced by intestinal failure (IF) patients. Omegaven®, an intravenous fish-oil emulsion has successfully treated advanced IFALD, but the impact of prolonged administration is not well described. Our objective was to determine long-term hepatic, histologic abnormalities and their clinical implications in patients treated with Omegaven®.

Methods: A retrospective cohort study of IF patients who received Omegaven® since 2006, and underwent at least 2 liver biopsies at different time points was performed. Biopsies were evaluated for inflammation, cholestasis and fibrosis and graded using Ishak scale. Biopsy findings were correlated with clinical findings. Medians and proportions were used to summarize data.

Results: Since 2006, 40/117 IF patients (34%) received Omegaven® for advanced IFALD, but six patients had biopsies at initiation of Omegaven® and after resolution of hyperbilirubinemia. Time to resolution of cholestasis with Omegaven® was 197 (93-309) days, duration of Omegaven® therapy was 858 (93-1761) days and time from cholestasis resolution to second biopsy was 725 (386-1469) days. Inflammation and cholestasis resolved in all 6 patients, while fibrosis progressed or remained stable in 4. Clinically, 2/6 patients developed portal hypertension, 1 required liver/intestine transplant and 1 is currently listed. 5/6 patients remained on PN at the time of final biopsy.

Conclusion: Omegaven® therapy is associated with reversal of cholestasis and inflammation, but persistence of fibrosis in most cases. There is no direct evidence that Omegaven® promotes fibrosis. Liver biochemistry does not correlate with degree of fibrosis and new non-invasive methods for fibrosis monitoring are required.

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Atropine as an alternative to re-pyloromyotomy in infants with recurrent pyloric stenosis

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Purpose: Recurrent hypertrophic pyloric stenosis (HPS) is a recognized entity, characterized by projectile non-bilious vomiting after an initially successful pyloromyotomy. Surgeons have classically treated this condition with a re-pyloromyotomy. Atropine has been controversially reported as an alternative treatment for HPS. Herein, we present our experience with atropine for the first time used in cases of recurrent HPS.

Methods: The health records department files were searched for the number of infants with recurrent HPS that were treated at our institution over a two-year period (Jan 2014-Jan 2016).

Results: During the study period, there were 3 infants, who at a median age of 29 days (29-51) underwent pyloromyotomy (2 laparoscopic, 1 open) for HPS. Following a documented period at home with tolerated feeds and weight gain, the infants presented with recurrent projectile vomiting at a median of 26 days (11-41) after surgery. Abdominal ultrasonography in 2 patients and upper gastrointestinal contrast study in 1 confirmed recurrent HPS. Atropine was administered intravenously for 2 days in all 3 infants at 0.01mg/kg/dose 6 times per day 5 minutes prior to feeding and was converted to oral (0.02mg/kg/dose 6 times per day) in one at a tapering dose over 4 weeks. Tachycardia was documented in one patient. Full feeds were reestablished at a median of 3 days. All infants were successfully treated and remain asymptomatic at a median follow-up of 6 months.

Conclusion: This study reports for the first time the successful use of atropine as a valid alternative to re-pyloromyotomy in infants with recurrent pyloric stenosis.

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Corrected to uncorrected? The metabolic conundrum of hypertrophic pyloric stenosis

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Purpose: To evaluate factors associated with reversion of corrected metabolic derangement back to uncorrected form (hypo- or hyperkalemia, hypochloremia and/or metabolic alkalosis) in preoperative management of infants with Hypertrophic Pyloric Stenosis (HSP) AND factors associated with repeat blood testing after establishment of metabolic correction.

Methods: A 16-year retrospective review of HPS cases admitted to a single pediatric centre. Cases demonstrating a reversion of a corrected metabolic derangement back to uncorrected form (hypo- or hyperkalemia, hypochloremia and or metabolic alkalosis) with repeat blood tests and cases in which a repeat test was ordered after an already normal chemistry panel were identified. Associations between patient and caregiver variables were determined using univariate analyses and multivariate logistic regressions.

Results: 255 cases were studied, 82% male, mean age 5.4 wks, mean weight 4108g and 27% were on acid-suppressing medication. A median of 2 lab tests were drawn per patient, ranging from 1 to 9. Of 381 serum chemistry tests repeated after a normal test, 81% were ordered by 3 of the 6 attending surgeons. Nine of these became minimally deranged by one metabolic parameter but no one variable was associated with the risk of this occurring. Those cases undergoing >5 tests showed consistent normal results beyond the 5th test.

Conclusion: There is little evidence to support the need for repeat serum chemistry testing in cases of HPS once a normal test has been established. Development of clinical pathways to reduce the use of unnecessary serum testing may be valuable to improve efficiency of patient care and limit unnecessary resource utilization.

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Comparing pyloromyotomy outcomes across Canada

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Purpose: To examine regional variations in surgical management and outcomes of infants with pyloric stenosis (PS) across Canada.

Methods: Hospitalization data on all patients treated with pyloromyotomy across Canada (excluding Quebec) between 2011 and 2013 was obtained. Associations of patient and provider variables with risks of complications and longer hospital stays were examined using Chi square and multivariate modelling. Geographic locations of cases were mapped using the 3-digit postal code.

Results: Of 1250 pyloromyotomies, 5% are treated in non-pediatric hospitals, with a similar distribution across the country. The overall risk of complications was 7%, with a 3-fold increased risk in infants with low birthweight (p=0.0007), and no difference in hospital type or general versus pediatric surgeon. Although average length of stay (LOS) was longer in non-pediatric versus pediatric hospitals (5.9d vs. 4.7d), this was not significant in adjusted models (p=0.15). Laparoscopic pyloromyotomy was performed by pediatric surgeons only, varying from 91% of cases in one province to 0% in others, but was not associated with a shorter LOS or increased complications. PS prevalence is two-fold greater in Eastern Canada and Nunavut (163/100K infants) compared to the West and NWT (75/100K infants).

Conclusion: Referral patterns for PS are similar around the country with equally good outcomes in pediatric versus non-pediatric centres, although case numbers are low in the latter, suggesting lessening of critical mass to maintain skills of non-pediatric surgeons. Continued uptake of laparoscopic approaches may push this trend further. Research into specific areas of increased PS prevalence could help identify underlying genetic risk factors for PS.

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Pleurectomy versus pleurodesis for primary spontaneous pneumothorax in children

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Purpose: Primary spontaneous pneumothorax (PSP) represents a common indication for urgent surgical intervention in children. First episodes are often managed with thoracostomy tube, whereas recurrent episodes typically prompt surgery involving a combination of bullectomy, pleurectomy, and/or pleurodesis. The purpose of this study was to assess whether pleurectomy or pleurodesis was associated with lower post-operative recurrence.

Methods: The medical records of patients undergoing thoracic surgery for PSP from January 2005 through December 2015 were retrospectively reviewed. Recurrence was defined as an ipsilateral pneumothorax requiring surgical intervention. Bivariate logistical regressions were used to identify factors associated with recurrence.

Results: Fifty-two patients underwent 64 index operations for PSP (12 patients had surgery for a contralateral pneumothorax and each instance was analyzed separately). The mean age was 15.7 ± 1.2 years and 79.7% (n=51) of patients were male. In addition to bullectomy, 53.1% (n=34) of patients underwent pleurectomy, 39.1% (n=25) underwent pleurodesis, and 7.8% (n=5) had no pleural treatment. The overall recurrence rate was 23.4% (n=15). Recurrence was significantly lower in patients who underwent pleurectomy rather than pleurodesis (8.8% vs. 40%, p<0.01). In patients who underwent pleurodesis without pleurectomy, the relative risk of recurrence was 2.36 [1.41-3.92, p<0.01].

Conclusion: Post-operative recurrence of PSP is significantly reduced in patients undergoing pleurectomy rather than pleurodesis.

<table>
<thead>
<tr>
<th></th>
<th>Pleurectomy (n=34)</th>
<th>Pleurodesis (n=25)</th>
<th>OR [CI]</th>
<th>p value</th>
</tr>
</thead>
<tbody>
<tr>
<td>Age (years) [mean ± SD] ‡</td>
<td>16.1 ± 1.1</td>
<td>15.3 ± 1.2</td>
<td>0.53 [0.30-0.85]</td>
<td>0.0144*</td>
</tr>
<tr>
<td>Gender [n (%)]</td>
<td></td>
<td></td>
<td></td>
<td>0.5508</td>
</tr>
<tr>
<td>Male</td>
<td>28 (82.4%)</td>
<td>19 (76.0%)</td>
<td>0.68 [0.19-2.47]</td>
<td></td>
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<tr>
<td>Female</td>
<td>6 (17.6%)</td>
<td>6 (24.0%)</td>
<td>1.47 [0.40-5.39]</td>
<td></td>
</tr>
<tr>
<td>Number of prior PSP episodes [mean ± SD] ‡</td>
<td>1.2 ± 1.1</td>
<td>0.9 ± 0.7</td>
<td>0.76 [0.39-1.33]</td>
<td>0.3519</td>
</tr>
<tr>
<td>Operative approach [n (%)]</td>
<td></td>
<td></td>
<td></td>
<td>0.0269*</td>
</tr>
<tr>
<td>VATS</td>
<td>26 (76.5%)</td>
<td>24 (96.0%)</td>
<td>7.38 [1.22-142.21]</td>
<td></td>
</tr>
<tr>
<td></td>
<td>Pleurectomy (n=34)</td>
<td>Pleurodesis (n=25)</td>
<td>OR [CI]</td>
<td>p value</td>
</tr>
<tr>
<td>--------------------------------------</td>
<td>--------------------</td>
<td>--------------------</td>
<td>-----------------</td>
<td>---------</td>
</tr>
<tr>
<td>Open</td>
<td>8 (23.5%)</td>
<td>1 (4.0%)</td>
<td>0.14 [0.01-0.82]</td>
<td></td>
</tr>
<tr>
<td>Number of wedge resections [mean ± SD] ‡</td>
<td>1.3 ± 0.7</td>
<td>1.2 ± 0.5</td>
<td>0.94 [0.40-2.15]</td>
<td>0.8811</td>
</tr>
<tr>
<td>Post-op length of stay (days) [median ± SD] ‡</td>
<td>5.0 ± 9.2</td>
<td>3.0 ± 2.4</td>
<td>0.77 [0.59-0.95]</td>
<td>0.0051**</td>
</tr>
<tr>
<td>Recurrences [n (%)]</td>
<td>3 (8.8%)</td>
<td>10 (40.0%)</td>
<td>6.89 [1.81-34.24]</td>
<td>0.0040**</td>
</tr>
<tr>
<td>Time to recurrence (days) [median ± SD] ‡</td>
<td>357.0 ± 362.1</td>
<td>568.5 ± 564.7</td>
<td>1.00 [0.99-1.00]</td>
<td>0.4083</td>
</tr>
<tr>
<td>Follow-up period (days) [median ± SD] ‡</td>
<td>41.5 ± 456.0</td>
<td>163 ± 533.9</td>
<td>1.00 [0.99-1.00]</td>
<td>0.1517</td>
</tr>
</tbody>
</table>

Odds ratios and 95% confidence intervals
* denotes p<0.05, ** denotes p<0.01
‡ denotes a continuous variable

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Do x-rays after chest tube removal change patient management?

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Purpose: A link between childhood radiation and future cancer risks exists, and reduction of unnecessary radiation in childhood has been recommended. Pneumothoraces, pleural effusions and many surgical procedures result in the placement of a chest tube or pigtail catheter. Traditional management is daily x-rays, with an x-ray after tube removal. Our hypothesis is that the “post pull” x-ray rarely results in a change in the clinical management of the patient.

Methods: With IRB approval a 5 year retrospective chart review was performed. Inclusion criteria were: chest tube or pigtail placed for any reason with records complete to post removal of the tube. Data collected included: demographics, reason for placement, duration of placement, number of x-rays done prior to and after removal. The primary outcome was whether the “post pull” x-ray changed clinical management.

Results: A total of 179 episodes were evaluated. Seventeen were excluded for incomplete data, or death/transfer of the patient with the tube in situ. Forty-nine tubes or pigtails were placed for pneumothorax, 48 for pleural effusion/empyema, 9 for hemothorax and 51 as part of an operative procedure. A median of 5 x-rays were done post insertion. 99% of the patients (160/162) had a “post pull” x-ray performed after tube removal. In only 9 cases did the post pull x-ray result in a change in patient management (new tube or VATS).

Conclusion: The x-ray performed after chest tube/pigtail removal rarely changes patient management. We recommend performing this imaging only with clinical symptoms, especially after removal of a pigtail.

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NOSIP, a modulator of nitric oxide production is increased in the colon of patients with Hirschsprung disease

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Purpose: Hirschsprung’s associated enterocolitis (HAEC) is the most common cause of morbidity and mortality in Hirschsprung’s disease (HSCR). Nitric oxide (NO) mediates intestinal homeostasis and is inhibited by NOSIP, a modulator of NO production. We designed this study to investigate the expression of NOSIP in the colon of patients with HSCR.

Methods: We investigated NOSIP, endothelial NO synthase and neuronal NO synthase expression in both the aganglionic and ganglionic regions of HSCR patients (n=10) versus normal control colon (n=10). Protein distribution was assessed by using immunofluorescence and confocal microscopy. Gene and protein expression were quantified using quantitative real-time polymerase chain reaction (qPCR), western blot analysis, and densitometry.

Results: qPCR and Western blot analysis demonstrate that NOSIP was significantly increased in the aganglionic and ganglionic colon compared to controls (p < 0.05). Confocal microscopy revealed a markedly increased expression of NOSIP in the colon epithelium of patients with HSCR compared to controls.

Conclusion: To our knowledge, we demonstrate for the first time the expression NOSIP in the human colon. The increased expression of NOSIP in the aganglionic and ganglionic bowel of HSCR may contribute to the development of enterocolitis by inhibiting local NO production in patients with Hirschsprung’s disease.
**Fig. 1 Immunofluorescence staining and confocal microscopy**
NOSIP protein and endothelial NO synthase (eNOS) protein expression in colonic tissue (green) of patients with Hirschsprung’s disease compared to controls. Ep-CAM (red) was used to identify colonic epithelium and to show co-expression with NOSIP and eNOS (original magnification x63; scale bar 25 µm)

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Loop versus divided colostomy for the management of anorectal malformations: a systematic review and meta-analysis

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Purpose: The ideal colostomy type for patients with anorectal malformations (ARM) is undetermined. We performed a systematic review and meta-analysis of short-term complications comparing loop and divided colostomies.

Methods: After review registration (PROSPERO:CRD42016036481), multiple databases were interrogated for comparative studies without language or date restrictions. Grey literature was sought. Complications investigated included stomal prolapse/hernia/retraction, wound infections and urinary tract infections (UTIs). Two reviewers independently assessed study eligibility; and study quality was determined using the Newcastle-Ottawa scale (NOS). Meta-analysis of selected complications was performed using Revman 5.3. The random effects model was employed to mitigate heterogeneity between studies; p<0.05 was considered significant.

Results: Twenty-six studies were included; four were multi-institutional. Reporting standards were highly variable with NOS scores ranging between 6-9 (max=9). Overall, 3866 neonates with ARM were incorporated which included 2241 loop colostomies and 1994 divided colostomies. Of 10 studies reporting short-term complications, the overall rate was 27%. Meta-analysis demonstrated no significant difference in UTI incidence, (OR: 2.55 [0.76, 8.58], p=0.12), while loop colostomies had significantly higher prolapse rates (See figure). No publication bias was noted.

Conclusion: A colostomy for patients with an ARM is a source of considerable morbidity. While UTI rates do not differ between stoma type, divided colostomies reduce the risk of subsequent prolapse and may represent the preferred approach.

<table>
<thead>
<tr>
<th>Study or Subgroup</th>
<th>Loop</th>
<th>Divided</th>
<th>Odds Ratio</th>
<th>Odds Ratio</th>
</tr>
</thead>
<tbody>
<tr>
<td></td>
<td>Events</td>
<td>Total</td>
<td>Events</td>
<td>Total</td>
</tr>
<tr>
<td>Wilkins 1988</td>
<td>4</td>
<td>57</td>
<td>1</td>
<td>250</td>
</tr>
<tr>
<td>Patwardhan 2001</td>
<td>5</td>
<td>39</td>
<td>3</td>
<td>10</td>
</tr>
<tr>
<td>Sheikh 2006</td>
<td>9</td>
<td>51</td>
<td>4</td>
<td>20</td>
</tr>
<tr>
<td>Pena 2006</td>
<td>55</td>
<td>351</td>
<td>3</td>
<td>10</td>
</tr>
<tr>
<td>Demiroglu 2011</td>
<td>6</td>
<td>79</td>
<td>0</td>
<td>58</td>
</tr>
<tr>
<td>van den Hondel 2014</td>
<td>21</td>
<td>133</td>
<td>0</td>
<td>19</td>
</tr>
<tr>
<td>Lachey 2016</td>
<td>6</td>
<td>78</td>
<td>9</td>
<td>93</td>
</tr>
<tr>
<td>Total (95% CI)</td>
<td>861</td>
<td>1276</td>
<td>100.00</td>
<td>3.34 [1.01, 5.47]</td>
</tr>
</tbody>
</table>

Total events: 119; 61

Heterogeneity: Tau² = 0.82; Chi² = 20.52, df = 7 (P = 0.005); I² = 66%
Test for overall effect: Z = 1.97 (P = 0.05)

Figure: Forest plot of stoma prolapse in patients with an anorectal malformation (OR: 2.34 [1.01-5.47] p=0.05)
**Cost analysis of non-operative management of acute appendicitis in children**

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**Purpose:** To determine if non-operative management of acute appendicitis in children is more cost effective than appendectomy.

**Methods:** After IRB approval (#107535), a retrospective review of children (6-17yrs) with acute appendicitis treated non-operatively (NOM) from May 2012-May 2015 was compared to similar patients treated with laparoscopic appendectomy (OM). Inclusion criteria included symptoms < 48 hours, localized peritonitis and ultrasound confirmation of acute appendicitis. Variables analyzed included treatment type, failure rates, complications, length of stay, operative costs and total hospital costs.

**Results:** There were 26 NOM patients (30% female, mean age 12) and 26 OM patients (73% female, mean age 11). Median initial length of stay (LOS) (24.5hrs (NOM) vs 16.5 hrs (OM), p=0.2) as well as median total LOS (including all subsequent admissions) was similar for both groups (34.5 hrs (NOM) vs 17.5 (OM), p=0.2). The median cost of appendectomy was $1353.32 (range $781.24-$2729.97). 10/26 (38%) NOM patients eventually required appendectomy for ongoing pain or recurrent appendicitis. 4/26 (15%) OM patients were re-admitted (post-operative abscess (n=2), Clostridium difficile colitis (n=1), ongoing pain (n=1)). Median initial hospital admission costs were significantly higher in the OM group ($3,502.70 (OM) vs $1,870.37 (NOM), p=0.001). However, median total hospital costs were similar for both groups ($3,070.15 (OM) vs $2,620.70 (NOM), p=0.6).

**Conclusion:** Although initial hospital costs were significantly less in children with acute appendicitis managed non-operatively, total hospital costs were similar for both groups. The high failure rate of non-operative management in this series contributed to the total increased cost in the NOM group.

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Cost transparency of laparoscopic appendectomy—decreasing operating room margins while maintaining quality

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Purpose: Reduction of healthcare costs while maintaining quality is the challenge for modern healthcare system. We investigated methods to decrease operating room costs for laparoscopic appendectomy (LA) through system based transparency.

Methods: We provided 3 pediatric surgeons with an itemized cost analysis of all laparoscopic appendectomies in 2014 at a free-standing pediatric hospital. Necessity to decrease cost was emphasized. Cost transparency was initiated allowing surgeons to review cost data of each partner. We then repeated an itemized cost analysis in 2015 to assess for expenditure & equipment changes. Methods utilized to decrease cost were analyzed. Demographics and outcome data was also retrospectively collected. Subset analysis for single incision appendectomy (SILS) was performed.

Results: LA was performed in 274 children. SILS LA was performed in 32%. Results in Table 1. Primary decrease in cost was obtained by endoclip use rather than stapler use for control of the appendiceal stump. Additionally, use of endocatch bags significant decreased. Finally, vendor consolidation of ports contributed to significant decrease in cost. Operative time was on average 51 minutes and 48 minutes in 2014 and 2015, respectively (p=0.15).

Conclusion: We conclude that institution of a group cost transparency model motivates surgeons to decrease cost expenditures while maintaining quality of care. Single-incision laparoscopic appendectomy cost remains unchanged due to high cost of access ports.

Table 1: Results

<table>
<thead>
<tr>
<th>COST DATA</th>
<th>All LA</th>
<th>Traditional LA</th>
<th>SILS LA</th>
</tr>
</thead>
<tbody>
<tr>
<td>2014 cost</td>
<td>$1107</td>
<td>$1193</td>
<td>$760</td>
</tr>
<tr>
<td>2015 cost</td>
<td>$401</td>
<td>$250</td>
<td>$705</td>
</tr>
<tr>
<td>Cost savings</td>
<td>$706</td>
<td>$943</td>
<td>$55</td>
</tr>
</tbody>
</table>

<table>
<thead>
<tr>
<th>OUTCOMES DATA</th>
<th>2014 (n=124)</th>
<th>2015 (n=150)</th>
<th>p value</th>
</tr>
</thead>
<tbody>
<tr>
<td>Length of stay</td>
<td>0.5 +/- 2.3</td>
<td>0.5 +/- 0.7</td>
<td>0.42</td>
</tr>
<tr>
<td>Readmission</td>
<td>4.9%</td>
<td>4.1%</td>
<td>0.77</td>
</tr>
<tr>
<td>Perforated</td>
<td>23.8%</td>
<td>23%</td>
<td>0.89</td>
</tr>
<tr>
<td>Interval</td>
<td>6.6%</td>
<td>9.5%</td>
<td>0.001</td>
</tr>
<tr>
<td>SILS</td>
<td>29.5%</td>
<td>36.5%</td>
<td>0.25</td>
</tr>
</tbody>
</table>

Glycerin suppositories used prophylactically in premature infants (SUPP): a pilot study for a multicenter randomized controlled trial

Michael H Livingston \(^1,2,7\), Henrietta Blinder \(^1\), Connie Williams \(^3,4\), Sarah A Jones \(^8\), Peter L Rosenbaum \(^4,5\), J Mark Walton \(^1,6\)

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Purpose: To assess the feasibility of a multicentre randomized controlled trial on the safety and effectiveness of glycerin suppositories in premature infants. These medications are used routinely in many neonatal intensive care units but the evidence for this practice remains limited and inconclusive.

Methods: We conducted a pilot study for a multicenter randomized controlled trial of premature infants randomized to once daily glycerin suppositories or a placebo procedure. Feasibility outcomes included cost, recruitment rate, and treatment-related adverse events.

Results: Between January and June 2015, we randomized 22 premature infants born less than 32 weeks gestation and/or 1500 grams. Of the 61 infants screened, 46 (75%) were eligible, 25 (54%) consented, 22 (48%) were randomized, and 19 (31%) reached full enteral feeds. Three infants (14%) experienced rectal bleeding 5 to 43 days after completing study treatments. Two of these events were due to cow’s milk protein allergy. There were no cases of rectal perforation or necrotizing enterocolitis. Protocol violations occurred on 14 of 130 (11%) treatment days. Complete meconium evacuation was achieved by a mean of 7.4 days in the treatment group and 8.9 days with the placebo procedure. Time to full enteral feeding was 6.5 days with treatment and 8.0 days with placebo. The total cost for each participant randomized was $700.

Conclusion: Conducting a multicentre randomized controlled trial of glycerin suppositories in premature infants is feasible and safe. A definitive trial is needed to assess the effectiveness of glycerin suppositories in this patient population.

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Long-term outcomes of newborns with necrotizing enterocolitis: a retrospective matched cohort study

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Purpose: Necrotizing Enterocolitis (NEC) is the most common surgical emergency in newborns. NEC’s relationship with poor neurocognitive outcomes is established; however additional longitudinal outcomes remain limited, especially for non-surgical NEC. This study explores the association of NEC with longitudinal gastrointestinal morbidity and growth outcomes.

Methods: Retrospective matched cohort study of newborns admitted to a level 3 NICU (2008-2011) was performed. Babies diagnosed with NEC and controls matched on birthweight and gestational age were included. Demographic and clinical data were reviewed. Primary outcomes included long-term gastrointestinal diagnoses (GI-Dx; ie: abdominal pain, intestinal gas, jaundice, feeding intolerance, constipation, hernias, ostomy care) recorded at subsequent encounters following NICU discharge. Logistic regression models were developed to examine which demographic and clinical variables were associated with these outcomes.

Results: 260 neonates were included: 130 with NEC, 130 controls. Of the NEC cases, 81% (n=105) were Bell’s stage 1, and 19% (n=25) were stage 2 or 3. Similar percent of control and NEC infants exceeded the 25th growth percentile for height (58% vs. 63%) and weight (64% vs. 53%). In multivariable analysis, history of NEC (OR 5.42 [2.10, 13.98]) was significantly associated with presence of long-term medical GI-Dx. Higher morbidity in NICU was associated with long-term surgical GI-Dx.

Conclusion: Neonates diagnosed with NEC exhibit increased medical gastrointestinal morbidity in long-term follow-up. Growth outcomes are comparable between NICU graduates with and without NEC. Data analysis for this study is ongoing to include babies born 1989-2007 (~650 additional patients) to improve power and further investigate outcomes over an even longer term.

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A comparison of Broviac and peripherally inserted central catheters in children with intestinal failure

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Purpose: Central venous catheters (CVCs) are a source of morbidity for children with intestinal failure (IF). Complications include infections, catheter breakage and occlusion, and venous thrombosis. Broviac catheters are commonly used in these patients, but peripherally inserted central catheters (PICCs) are gaining popularity. This study compares complications between Broviacs and PICCs in children with IF.

Methods: After IRB approval, children with IF receiving parenteral nutrition (PN), in our Intestinal Rehabilitation Program between 2012 and 2016 were reviewed. CVC complications were compared between Broviacs and PICCs. Data was analyzed with the generalized estimation equation population-averaged Poisson regression model, p<0.05=significant.

Results: Thirty-six children (0.1-16 years) with IF were reviewed, accounting for 27,230 catheter days, 108 Broviacs (3F-9F) and 54 PICCs (2-11F). Overall, Broviacs had a significantly higher infection rate, but PICCs were more likely to break. However, when catheters of similar size (3F) were compared there were no statistically significant differences (Table 1). Thirteen children (36%) had at least one central venous thrombosis, all after Broviac placement. Three children (8%) had basilic vein thrombosis after PICC placement.

Conclusion: Children with IF often require CVCs for the delivery of PN. Although Broviacs and PICCs have similar complication rates, in this study there were no central venous thromboses associated with PICCs. This should be considered when placing catheters in these patients.
Table 1: Central venous catheter complications in children with IF

<table>
<thead>
<tr>
<th></th>
<th>Infections per 1000 catheter days</th>
<th>Breakages per 1000 catheter days</th>
<th>Occlusions per 1000 catheter days</th>
</tr>
</thead>
<tbody>
<tr>
<td>All Broviacs (108)</td>
<td>4.20</td>
<td>0.26</td>
<td>5.50</td>
</tr>
<tr>
<td>All PICCs (54)</td>
<td>2.60</td>
<td>1.56</td>
<td>7.00</td>
</tr>
<tr>
<td>P value</td>
<td>0.011*</td>
<td>0.002*</td>
<td>0.305</td>
</tr>
<tr>
<td>3F Broviacs (22)</td>
<td>2.80</td>
<td>2.00</td>
<td>5.95</td>
</tr>
<tr>
<td>3F PICCs (43)</td>
<td>5.80</td>
<td>1.50</td>
<td>11.20</td>
</tr>
<tr>
<td>P value</td>
<td>0.633</td>
<td>0.14</td>
<td>0.222</td>
</tr>
</tbody>
</table>

*= statistically significant

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Two year follow-up of children with surgically and conservatively treated necrotizing enterocolitis

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Purpose: Necrotizing enterocolitis (NEC) in very low birth weight infants is a risk factor for developmental delay. No studies have been performed to measure the neurodevelopmental outcome of patients with NEC treated surgically versus conservatively. The aim of this study was to measure the neurodevelopmental outcome of patients with NEC treated either surgically or conservatively.

Methods: All patients were identified suffering from NEC born from 2006 to 2013. NEC was defined according to Bell stage. All patients had antibiotic therapy, nasogastric decompression and fasting. Surgical treatment was indicated for Bell stage > IIIa. We excluded all patients suffering from other relevant diseases with impact on neurodevelopment (intraventricular haemorrhage, associated malformations, asphyxia). All patients were tested at the corrected age of 24 month with the Bayley Scales of Infant Development II.

Results: We included 24 surgical and 13 conservatively treated very birth weight infants. The outcome was split into the psychomotor index (PDI) and mental developmental index (MDI). The patient group without surgery achieved a mean PDI of 107 and the group with surgery achieved 94. These values were significantly better for the conservative group. The mean MDI was 99 in the patient group without surgery and 89 in the group with surgery. This difference was also significant.

Conclusion: We found lower MDI and lower PDI in children with surgical treatment. This may be ascribed to their critical condition and/or to the impact of anaesthesia. These results show the stringent necessity of further systematic prospective research.

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Intestinal epithelial cell viability is increased by the addition of breast-milk derived exosomes

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Purpose: Breast milk administration has been shown to prevent necrotizing enterocolitis (NEC); however, the mechanism of breast milk protection remains unclear. Exosomes are cell-derived vesicles that mediate intercellular signaling, inflammation, and immune response. We hypothesized that exosomes isolated from breast milk have beneficial effects in intestinal epithelial cells.

Methods: Rat breast milk was centrifuged to eliminate fat, cells and debris, and exosomes were isolated using ExoQuick reagent, and visualized by Nanoparticle Tracking Analysis. Protein was extracted from encapsulating exosomes using Cell Extraction Buffer, and concentration was measured by BCA protein assay. 2x10^4 intestinal epithelial cells (IEC-18) were treated for five hours with 0.5µg/µl milk exosomes, an equal volume of exosome-free milk, or control solution (PBS). IEC-18 cell viability was measured using a colorimetric assay (MTT), and data were compared using one-way ANOVA with Bonferroni post-test.

Results: Compared to control (0.18±0.01), IEC-18 viability was significantly greater after treatment with milk-derived exosomes (0.24±0.01, p<0.05). Conversely, exosome-free rat milk (0.20±0.01) did not enhance viability (Figure).

Conclusion: Rat breast milk-derived exosomes promote intestinal epithelial cell viability, whereas exosome-free milk has no effect. These findings provide insight into the mechanism of action of breast milk on intestinal epithelial cells. Exosome administration is a promising prevention method for infants at risk of developing necrotizing enterocolitis when the administration of breast milk is not tolerated.
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Predictors of intestinal adaptation in paediatric intestinal failure (IF): a retrospective cohort study

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Purpose: The primary goal of treatment in IF is intestinal adaptation and achievement of full enteral autonomy. The goals were to determine the proportion of patients treated for IF by an established intestinal rehabilitation program who achieved enteral autonomy and to assess the predictors of enteral autonomy.

Methods: A retrospective analysis of infants <12 months with IF secondary to short bowel syndrome (SBS) referred between January 2006 and December 2013 (n=120). Data was collected on IF related factors and nutritional intake. The cohort was stratified based on achievement of enteral autonomy. Statistical testing completed using T-test, Chi Square and Cox Proportional Hazards regression (p < 0.05).

Results: Enteral autonomy was achieved in 84 (70.0%) patients. Patients who remained PN dependent were more likely to have gastroschisis [36.1% vs 25.0%; P<0.0001], shorter percent residual small bowel [29.4% vs 68.6%; P=0.001] and colon length [64.6% vs 86.0%; P=0.001], and no ileocecal valve [61.1% vs 29.8%; P=0.05]. There was no difference in the number of septic episodes, proportion who developed IFALD or received transplantation. Achievement of enteral autonomy had a lower mortality [3/884 (3.6%) vs 8/36 (22.2%); P=0.004] and no mortality from IFALD. Percent residual small bowel [HR=1.03; 95% CI 1.02-1.03] and colon [HR=1.01; 95% CI 1.00-1.02] length were positively associated with enteral autonomy, while number of septic episodes was negatively associated [HR=0.95; 95% CI 0.91-0.99].

Conclusion: 70% of infants with IF achieved enteral autonomy. Residual small and large bowel length were the most important predictors of enteral autonomy and septic events had a negative impact on patients’ achievement of enteral autonomy.

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Poor gastric emptying correlates to the severity of intestinal damage in experimental NEC

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Purpose: Neonates with necrotizing enterocolitis (NEC) develop paralytic ileus. Assessing gastric emptying may be useful in evaluating NEC severity. The purpose of this study was to assess gastric emptying in experimental NEC using abdominal ultrasound.

Methods: Following ethical approval (no.32238), NEC was induced by gavage feeding of hyperosmolar formula, hypoxia and lipopolysaccharide between postnatal days 5 and 9 (n=10). Breastfed mice served as control (n=4). Gastric residual volume and stomach size were measured by two abdominal ultrasounds on day 5 (baseline) and 9. In both groups measurements were taken soon after feeding and after 4 hours fasting. At sacrifice (day 9), the distal ileum was harvested for histology and qPCR analysis. Data were analyzed using Mann-Whitney test

Results: There were no differences at baseline between the groups. On day 9, NEC mice had a greater gastric residual volume compared to control (p=0.002, Fig. A) indicating delay in gastric emptying. There were positive correlations between gastric residual volume and both IL-6 levels and histological bowel damage, indicating that greater delay in gastric emptying is associated with greater intestinal inflammation and more severe damage (p=0.035, p=0.012, respectively, Fig. B).

Conclusion: During NEC, a delay in stomach emptying is related to disease severity. Ultrasound assessment of gastric emptying is a new non-invasive imaging modality that could be used to predict NEC severity.

Figure

![Figure A](image1.png)

![Figure B](image2.png)
Endoplasmic reticulum stress in intestinal epithelium during necrotizing enterocolitis

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Purpose: Endoplasmic reticulum (ER) stress is associated with gut mucosal injury as seen in necrotizing enterocolitis (NEC). We hypothesized that ER stress is activated in NEC, leading to intestinal epithelial cell apoptosis, and that the administration of amniotic fluid stem (AFS) cells can prevent this effect.

Methods: Following ethical approval (n.32238), NEC was induced in 5-day old neonatal C57BL/6 mice using gavage feeding of hyperosmolar formula, hypoxia and oral lipopolysaccharide (4mg/kg). On days 6 and 7, mice received an intraperitoneal injection of phosphate buffered saline (PBS; n=10) or 2x10⁶ AFS cells (n=10). Breastfed mice (n=10) served as control. On day 9, animals were sacrificed and ileum samples were analysed for markers of ER stress (BiP, CHOP) and apoptosis (CC3) by western blot. Data were compared using one-way ANOVA with Bonferroni post-test.

Results: Compared to control, NEC mice had higher relative protein expression of ER stress indicated by increased BiP (p<0.05, Figure) and CHOP (p<0.05), and higher expression of apoptosis (p<0.05). Administration of AFS cells reduced the expression of BiP (p<0.05), CHOP (p<0.05), and CC3 (p<0.05) to control levels.

Conclusion: 1) ER stress is activated during experimental NEC. 2) ER stress inhibition represents a novel target for NEC therapy. 3) The administration of AFS cells protects the intestinal epithelium from ER stress-induced apoptosis.
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Microbiome analysis in experimental necrotizing enterocolitis

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Purpose: Previous studies have shown that probiotic use in premature infants can prevent the development of necrotizing enterocolitis (NEC), and germ-free rodents do not develop NEC. The types of bacteria and their contributions to the pathophysiology of NEC remain unclear. The aim of the present study was to characterize changes in microbiome during NEC in mice.

Methods: Following ethical approval (no. 32238), 5-day-old C57BL/6 mice were randomized into two groups: control [n=4] and NEC [n=4]. NEC was induced by gavage feeding of hyperosmolar formula, hypoxia and enteral lipopolysaccharide administration. Microbial DNA in ileal contents was extracted, and analyzed by qPCR with primers specific for 16S ribosomal RNA genes, differentiating the genus and phylum levels (firmicutes, bacteriodetes, actinobacteria, gamma-proteobacteria, and lactobacilli) relative to universal primers. Data were compared using the Mann-Whitney test.

Results: Lactobacilli levels were decreased in NEC compared to control mice (0.008 ± 0.0062 vs. 0.107 ± 0.054, p=0.029, Figure). There were no significant differences in firmicutes, bacteriodetes, actinobacteria, gamma-proteobacteria, and bacteroïdetes / firmicutes ratio between control and NEC groups.

Conclusion: This study indicates that the relative composition of intestinal microbiome is altered in NEC. This unbalance is reached already after 4 days of NEC induction indicating that the intestinal injury in neonates causes early changes in gut microorganisms.
Figure

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The role of adjunctive procedures in reducing postoperative tracheobronchial obstruction in single lung patients with congenital tracheal stenosis undergoing slide tracheoplasty

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Purpose: Patients with congenital tracheal stenosis (CTS) and right single lung treated with slide tracheoplasty (STP) face high rates of postoperative tracheobronchial obstruction from tracheobronchomalacia and tracheal “kinking” caused by retroaortic entrapment and tracheal traction caused by mediastinal shift. Herein we report a single institution’s experience with adjunctive procedures at the time of STP to reduce postoperative tracheal obstruction in right single lung patients with CTS.

Methods: With IRB approval, 8 right single lung patients with CTS who underwent STP in our institution between 2008 and 2016 were reviewed.

Results: (Table 1) Seven of 8 patients (88%) survived, with a median follow-up period of 32 (1-86) months. The only mortality was due to complications unrelated to the airway. Six of 8 patients underwent CTS anterior to the aortic arch (tracheal translocation, TT); in 3 this was combined with tracheopexy. Two patients had insufficient tracheal length for TT; both underwent aortopexy. Of three patients undergoing TT with tracheopexy, two have been extubated and a third (without significant tracheobronchomalacia) has required tracheostomy for subglottic stenosis. All patients undergoing TT without tracheopexy have experienced severe tracheobronchomalacia.

Conclusion: We conclude that adjunctive TT with tracheopexy is associated with lower rates of tracheobronchial obstruction in right single lung patients undergoing STP for CTS.
<table>
<thead>
<tr>
<th>Age at surgery (months)</th>
<th>Other major anomalies</th>
<th>Adjunctive procedure</th>
<th>Outcome / Length of Follow-up (months)</th>
<th>Major complications</th>
</tr>
</thead>
<tbody>
<tr>
<td>11</td>
<td></td>
<td>Tracheal translocation, Tracheopexy</td>
<td>Alive (86 m) Extubated</td>
<td>none</td>
</tr>
<tr>
<td>0</td>
<td>VATER association, Intestinal duplication cyst</td>
<td>Aortopexy</td>
<td>Died of hepatic failure (3 m)</td>
<td>Ischemic bowel obstruction, Short bowel syndrome</td>
</tr>
<tr>
<td>5</td>
<td>VATER association</td>
<td>Tracheal translocation</td>
<td>Alive (66m) Tracheostomy due to tracheobronchomalacia (decannulated at 32 months)</td>
<td></td>
</tr>
<tr>
<td>9</td>
<td></td>
<td>Tracheal translocation</td>
<td>Alive (45m) Extubated</td>
<td>none</td>
</tr>
<tr>
<td>7</td>
<td>Bronchopulmonary foregut malformation</td>
<td>Tracheal translocation</td>
<td>Alive (42m) Tracheostomy due to tracheobronchomalacia</td>
<td></td>
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<tr>
<td>18</td>
<td>Subglottic stenosis</td>
<td>Tracheal translocation</td>
<td>Alive (22m) Tracheostomy due to subglottic stenosis</td>
<td></td>
</tr>
<tr>
<td>24</td>
<td>Tracheoesophageal fistula</td>
<td>Tracheal translocation</td>
<td>Alive (2m) Extubation failure due to tracheobronchomalacia (awaits tracheopexy)</td>
<td></td>
</tr>
<tr>
<td>27</td>
<td></td>
<td>Aortopexy</td>
<td>Alive (1m) Extubated</td>
<td>none</td>
</tr>
</tbody>
</table>

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Peroral endoscopic myotomy in a large cohort of children: safety and efficacy mid-term results

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Purpose: Peroral endoscopic myotomy (POEM) has been recently established as a reference treatment for esophageal achalasia. Data about POEM in children are limited.

Methods: This retrospective, multi-centric study evaluated safety and efficacy of POEM in children at three tertiary referral centers. Main outcome measures: intra-procedural and in-hospital adverse events, clinical/endoscopic follow up data (for safety) and Eckardt score ≤3 (for efficacy).

Results: A total of 47 Children (age range 2-17 years) underwent POEM between 2011 and 2015 in Japan and 22 in Italy): Table 1. The procedure was successful in 46/47 patients (97.8%). In a 6 years old girl, during a difficult submucosal tunnel creation because of severe fibrosis, a mucosal perforation was diagnosed. The procedure was aborted and a conservative management for a covered leakage was established. The patient underwent elective Heller Myotomy. The clinical course was uneventful in the other patients (97.8%) and mean hospital stay was 4 days (range 2-9). An Eckardt score ≤3 was confirmed in all completed POEMs and the mean follow up was 10 months (range 1-36). Symptomatic GERD was reported in 4 patients (8.5%) as well as the use of PPI. The one-year follow up endoscopy, confirmed a Grade-A GERD in 2/14 patients (14.2%).

Conclusion: Safety and mid-term efficacy of POEM in pediatrics were confirmed by our large multicenter series. Long term follow-up data are necessary to definitely delineate the role of POEM in the management of pediatric achalasia.

Table 1: Baseline characteristics of patients who underwent second POEM

<table>
<thead>
<tr>
<th>Demographics</th>
<th></th>
</tr>
</thead>
<tbody>
<tr>
<td>N. of patients</td>
<td>47</td>
</tr>
<tr>
<td>Age, median (range), y</td>
<td>11.9 (2-17)</td>
</tr>
<tr>
<td>Male, n. (%)</td>
<td>23 (49)</td>
</tr>
<tr>
<td>BMI, mean (range)</td>
<td>16 (11-24)</td>
</tr>
<tr>
<td>Comorbidities, n: Down Syndrome, AAA Syndrome</td>
<td>2, 1</td>
</tr>
<tr>
<td>---------------------------------------------</td>
<td>------</td>
</tr>
</tbody>
</table>

<table>
<thead>
<tr>
<th><strong>Achalasia characteristics</strong></th>
<th></th>
</tr>
</thead>
<tbody>
<tr>
<td>Duration of symptoms, mean (range), months</td>
<td>21 (2-79)</td>
</tr>
<tr>
<td>Type of Achalasia(^1), n.: I, II, III, not available</td>
<td>10, 15, 2, 20</td>
</tr>
<tr>
<td>Manometry IRP, mmHg: mean (range)</td>
<td>31 (11-51)</td>
</tr>
<tr>
<td>Esophageal dilation, n (%): none, mild, moderate, severe</td>
<td>37 (79), 1 (2), 5 (11), 1(2)</td>
</tr>
<tr>
<td>Eckardt Score, mean (range)</td>
<td>6.9 (3-11)</td>
</tr>
<tr>
<td>Previous treatments: Pneumatic Balloon Dilation, n (%)</td>
<td>13 (27)</td>
</tr>
</tbody>
</table>

\(^1\) According to Chicago Classification v. 3.0

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Use of bedside abdominal ultrasound to confirm intestinal motility in neonates with gastroschisis: a feasibility study

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Purpose: Optimal timing to begin feeds in neonates with gastroschisis remains unclear. We examined if bedside abdominal ultrasound for intestinal motility could detect return of bowel function.

Methods: After IRB approval, neonates born with uncomplicated gastroschisis underwent postoperative ultrasound exams of all four abdominal quadrants to evaluate for peristalsis. Full motility was defined as peristalsis in all quadrants. The neonatal team was blinded to ultrasound findings. Criteria to determine when to begin enteral feeds included daily bowel movements, gastric residuals, and characteristic of nasogastric tube output (ie–bilious). Average length of time between abdominal wall closure and start of enteral feeds, full ultrasound motility, and clinical characteristics was compared using student’s t tests.

Results: Seventeen patients were enrolled. Mean time to enteral feeds (11.82 days) was significantly delayed compared to documentation of full motility on ultrasound (8.94 days; p<0.001), consistent bowel movements (8.41 days; p=0.006), low gastric residuals (9.47 days; p<0.001) and nonbilious residuals (9.18 days; p<0.001). In the single subject in which feeds were started before full motility was seen on ultrasound, feeds were subsequently discontinued due to emesis, and then restarted after full motility was documented on ultrasound.

Conclusion: Bedside abdominal ultrasound provides real-time evidence regarding intestinal motility in neonates with gastroschisis and can shorten time to enteral feeds by approximately 3 days when used in conjunction with clinical findings. Ultrasound may also detect loss of intestinal motility before clinical signs of feeding intolerance develop, and can therefore be a feasible screening tool for prompt recognition of nonfunctioning bowel and the need to discontinue feeds.

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The laparoscopic ovary-sparing excision of a benign teratoma

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Purpose: Laparoscopic excision of a benign ovarian teratoma is demonstrated. Case History: A nine year-old female had two months of abdominal pain. MRI revealed a 3.5 cm calcified mass in the right ovary. Tumor markers were negative.

Method: Under general anesthesia, three laparoscopic ports were placed. A 12-mm port was placed directly above the right ovary. The adnexal structures were mobilized. The ovary was placed in an endocatch bag and pulled through the 12-mm port-site. The hydroplane technique of saline injection under the serosa allowed dissection of the mass from normal ovary. The serosa was opened and the mass circumferentially excised. The preserved ovary was closed with running suture of 3-0 chromic and replaced in the abdomen.

Results: A benign 3.0 cm teratoma was completely excised.

Conclusion: Complete excision of a benign ovarian teratoma that combines the benefits of laparoscopy with ovary preservation and avoidance of tumor spillage is demonstrated.

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Titanium plate fixation of flail chest in pediatric blunt trauma: long-term outcomes for two cases

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Purpose: We present outcomes of rib plating in two pediatric patients with flail chest. Patient 1 is a 12 year old male ATV driver with left thorax handlebar impalement with a flail segment of ribs 4-8. He was unable to wean from the ventilator by hospital day (HD) 4 and had titanium plating of ribs 4-7. He was extubated on postoperative day (POD) 1 and discharged home on POD 5. He returned to contact sports at 6 months. Patient 2 is a 13 year old male dirt bike rider with fractures of left ribs 8-12, including a 9-10 flail segment. He was unable to wean from the ventilator by HD 3 and had titanium plating of ribs 8-10. He was extubated on POD 2 and discharged on POD 11. After 4 months of therapy, he returned to full activity. Both patients had symmetric chest growth at 3 and 2 years, respectively.

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Potential pitfalls of laparoscopic inguinal hernia repair in children: report of an unrecognized sliding hernia and other rare complications

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Purpose: Laparoscopic inguinal hernia repair (LIHR) has been shown to be safe and effective in the pediatric population. However, there are a number of complications that are unique to this approach. The purpose of this study is to describe a case of a missed sliding hernia and to review the literature on other potential pitfalls of this new technique.

Methods: A literature search was performed on all pediatric LIHR studies published over the last 20 years. Studies reporting complication rates were included, as were case reports describing complications with the use of laparoscopy.

Results: While most series report peri and postoperative complication rates of LIHR as <1% with recurrence rates of <5%, other more unique complications of LIHR have been recorded in the literature including, transient or persistent hydrocele, testicular ascent, port site hernias and omental evisceration, iliac vein puncture with resulting retroperitoneal hematoma, and bowel strangulation secondary to adhesive disease. In our experience, we have encountered an early postoperative “recurrent” hernia which was found to be a sliding hernia not recognized during LIHR. This was readily recognized and repaired with the open approach.

Conclusion: Although LIHR is generally considered a safe practice with low complication rates, our review elucidates several examples of unexpected sequelea of this approach. As laparoscopic techniques become increasingly used by pediatric surgeons, it is imperative that both experienced and more novice practitioners of laparoscopy recognize the potential pitfalls unique to laparoscopic repair.

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Combination trophic peptide therapy for neonatal short bowel syndrome

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Purpose: To determine if combined administration of glucagon-like peptide-2 and epidermal growth factor improves intestinal adaptation in neonatal short bowel syndrome.

Methods: Neonatal piglets (n=38) were block randomized to saline control, glucagon-like peptide-2 (11 nmol/kg/day) alone, epidermal growth factor (80 µg/kg/day) alone, or combined glucagon-like peptide-2 and epidermal growth factor therapy for seven days following a 75% distal intestinal resection (removing all ileum) or no resection (sham control). Structural adaptation was assessed by gross intestinal morphology and histology. Functional adaptation was assessed by intestinal permeability via Üssing chamber analysis. Remnant intestinal qRT-PCR was performed to determine the relative expression of genes involved in intestinal repair (trefoil factor 3), permeability (claudin-15) and intestinal growth (insulin-like growth factor 1). Data was analyzed by 2-way ANOVA, with a level of significance set at p < 0.05.

Results: Combination therapy increased remnant intestinal length compared to saline (p=0.01) while monotherapy did not. Glucagon-like peptide-2 increased intestinal mucosal weight in comparison to epidermal growth factor alone (p=0.04). Both glucagon-like peptide-2 and combination therapy increased jejunal villus height (p<0.01). Combination therapy reduced intestinal permeability to mannitol (p=0.04) and polyethylene glycol compared to saline (p<0.01). Combination therapy increased trefoil factor 3 (p=0.03) and claudin-15 (p<0.05) expression over saline. Insulin-like growth factor-1 expression decreased with glucagon-like peptide-2 compared to epidermal growth factor treatment (p=0.01).

Conclusion: In this preclinical model of neonatal short bowel syndrome lacking ileum, reflecting the anatomy most encountered clinically, combined glucagon-like peptide-2 and epidermal growth factor administration demonstrated the most beneficial impact on remnant intestinal morphology, histology and function.
Outcome prediction in gastroschisis – the gastroschisis prognostic score (GPS) revisited

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Purpose: The GPS enables risk stratification in gastroschisis and helps discriminate low from high morbidity groups. The purpose of this study was to: (1) revalidate GPS’s characterization of a high morbidity group and (2) quantify relationships between the GPS and outcomes within this group.

Methods: With REB approval, complete survivor data from a national gastroschisis registry was collected. GPS bowel injury scoring was revalidated excluding the initial inception/validation cohorts (>2011). Length of stay (LOS), 1st enteral feed days (dFPO), TPN days (dTPN) and aggregate complications (COMP) were compared between low and high morbidity risk groups. Mathematical relationships between outcomes and integer increases in GPS were explored using the entire cohort (2005-present). Analyses were conducted with the aid of a biostatistician.

Results: Median (range) LOS, dFPO, and dTPN for the entire cohort (n=849) was 36(26, 62), 13(9, 18), and 27(20, 46), respectively. High-risk patients (GPS>2; n=80) experienced significantly worse outcomes than low risk patients (n=263). Each integer increase in GPS was associated with increases in LOS and dTPN by 16.9 and 12.7 days, respectively (p<0.01; Figure 1). COMP rate was also increased in the high-risk cohort (52.7% vs 31.8%; p<0.01)

Conclusion: The GPS effectively discriminates low from high morbidity risk groups. Within the high risk group, integer increases in GPS produce quantitatively differentiated outcomes which may guide initial counselling and resource allocation.
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Determinants of outcomes in patients with simple gastroschisis

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Purpose: While gastroschisis (GS) complicated by intestinal atresia, perforation, or necrosis is associated with higher morbidity and mortality, simple GS without these complications can still result in significant morbidity. We analyzed the determinants of outcomes in simple GS.

Methods: With ethics approval, all simple GS patients enrolled in a national registry from 2005-2013 were studied. Outcomes included total parenteral nutrition (TPN) duration and length of hospital stay. Patients at or below the median for TPN duration (26 days) and hospital stay (34 days) were compared to those above. Independent variables analyzed included maternal, patient, treatment and postnatal factors. Univariate and multivariate logistic regression analyses were employed.

Results: Of 700 patients with simple GS, representing 76.8% of all GS patients, 690 (98.6%) survived. TPN was used in 357 (51.6%) and 335 (48.4%) patients for < 26 and > 26 days, respectively. Hospital stay for 363 (52.2%) and 332 (47.8%) infants was < 34 and > 34 days, respectively. Univariate analysis revealed significant differences in several patient, treatment, and postnatal factors. On multivariate analysis, the variables in the table were independently associated with increased morbidity.

Conclusion: Bowel dilation is associated with increased morbidity in simple GS. Bowel matting severity is not an independent risk factor. CLABSI is the strongest predictor of prolonged TPN dependence and hospital stay.

<table>
<thead>
<tr>
<th>Variable</th>
<th>TPN Duration &gt; 26 days Odds Ratio (95% CI)</th>
<th>Hospital Stay &gt; 34 days Odds Ratio (95% CI)</th>
</tr>
</thead>
<tbody>
<tr>
<td>Sonographic Bowel Dilation</td>
<td>2.06 (1.31 – 3.25)</td>
<td>1.75 (1.14 – 2.68)</td>
</tr>
<tr>
<td>Older age at Closure</td>
<td>1.13 (1.05 – 1.21)</td>
<td>1.10 (1.03 – 1.17)</td>
</tr>
<tr>
<td>CLABSI</td>
<td>8.09 (3.62 – 18.1)</td>
<td>8.57 (3.94 – 18.60)</td>
</tr>
<tr>
<td>NEC</td>
<td>3.54 (1.06 – 11.8)</td>
<td>3.71 (1.14 – 12.00)</td>
</tr>
<tr>
<td>Longer mechanical ventilation</td>
<td>1.17 (1.10 – 1.25)</td>
<td>1.13 (1.07 – 1.19)</td>
</tr>
</tbody>
</table>

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Perioperative determinants of transient hypocalcemia after pediatric total thyroidectomy

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Purpose: This study aims to identify risk factors associated with post-operative hypocalcemia after pediatric total thyroidectomy.

Methods: We performed a retrospective review of pediatric patients (<21 years old) who underwent total thyroidectomy between January 2002-2016. Transient hypocalcemia was defined as serum calcium <8mg/dl or ionized calcium <1.0mmol/L during the post-operative hospitalization. Perioperative risk factors for transient hypocalcemia were identified through multivariate logistic regression with p-value <0.05 considered significant.

Results: Ninety-one children underwent total thyroidectomy. The average age was 13.7±4.4 years; 77% were female. Transient hypocalcemia was diagnosed in 34% (n=31) of patients, of which 39% (n=12) received intravenous calcium supplementation and 94% (n=29) were discharged on oral calcium supplementation. Ten (32%) patients developed symptomatic transient hypocalcemia; three symptomatic patients required intravenous calcium supplementation. There was no case of permanent hypoparathyroidism. Predictors of transient hypocalcemia included age (OR 0.89, 95% CI 0.80-0.98, p=0.02) and concomitant lymphadenectomy (OR 2.58, 95% CI 1.04-6.39, p=0.04). Patients with malignancy who have therapeutic central (OR 7.1, 95% CI 1.5-33.4, p=0.01) or central plus lateral lymphadenectomy (OR 6.33, 95% CI 1.0-40.1, p=0.05) had significantly increased risk for transient hypocalcemia compared to those without lymphadenectomy (42%). Surgical indication (nodule, malignancy, hyperthyroidism, MEN2A/B, goiter), pre-operative calcium supplementation, parathyroid tissue on pathology, and postoperative PTH<15pg/ml were not associated with transient hypocalcemia.

Conclusion: Younger patients and patients undergoing therapeutic concomitant lymphadenectomy have increased risk of developing transient hypocalcemia following total thyroidectomy. Central or central plus lateral lymphadenectomy in malignant cases also impart increased risk. Aggressive perioperative management of hypocalcemia should be initiated in patients with these risk factors.

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Safety and dosing of glucagon-like peptide 2 (GLP-2) in infants

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Purpose: Glucagon-like peptide 2 (GLP-2) analogues are approved for adults with intestinal failure (IF) but no studies of GLP-2 include infants. This study examined GLP-2 pharmacokinetics (PK), safety and nutritional effects in infants with IF.

Methods: Human GLP-2(1-33) was synthesized. With parenteral consent, (Health Canada Protocol:150979) 6 parenteral nutrition (PN) dependent infants were treated with 5-20 µg/kg/day GLP-2, subcutaneously (s.c.) for 3 days (Phase 1) and if tolerated, continued for 42 days (Phase 2). Nutritional treatment was directed by the primary caregivers; data was gathered weekly. Patients were followed to one year.

Results: Six patients were enrolled, age 5.4±3.2 months, bowel length: 27±12% of predicted, PN dependent (67±18% calories), and treated for 42 days. There were no effects on vital signs and no significant adverse events during the trial. Patients dosed at 5 µg/kg/day had GLP-2 levels of 52 (day 3) and 57 pM (day 42), with no change in half-life or endogenous GLP-2 levels. There was a numerical improvement in enteral feeds, weight, Z scores, stooling frequency and citrulline levels which improved further at 1 and 6 month follow-up. One patient was transplanted and one patient died from sepsis 4 months post treatment. The trial was discontinued early due to a drop in the potency of the peptide formulation.

Conclusion: GLP-2 was well tolerated in infants; the pK was similar to children. There were no changes in endogenous GLP-2 release. The findings suggest that GLP-2 ligands may be safely used in infants and may have beneficial effects on nutrient absorption; this requires confirmation.
GLP-2 Trial: pK data
Infants <1 yr
Day 3

GLP-2 Trial: pK data
Infants <1 yr
Day 42

Data mean ± STDev
n=4
The use of balloon dilation in post-operative strictures in children with short bowel syndrome

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Purpose: Children with short bowel syndrome (SBS) often require numerous operations to optimize intestinal function and absorptive capacity. Post-operative intestinal strictures are a complication that result in re-operation, inhibit enteral feeding advancement and prolong parenteral nutrition dependency. Our objective was to review our experience with image-guided pneumatic dilatation to treat intestinal strictures in pediatric patients with SBS.

Methods: A retrospective cohort study of intestinal failure patients with SBS between 2011 and 2015 was completed. Patients who had fluoroscopically diagnosed intestinal strictures, treated with balloon dilatation, by an interventional radiologist were included [n=6]. Data related to demographics, anatomy, surgical procedures, dilatation procedures, location of strictures, time to enteral feeds and complications was collected. Descriptive summary statistics were employed.

Results: 98 intestinal failure patients were recruited between 2011 and 2015. Six of 98 patients (6.1%) received balloon dilatation [3 males; 4.4 months median age at surgery]. 1 stricture was in upper intestine and 5 strictures were accessible from the colon. Dilatation was successful in 4/6 (67%). The median number of dilatations was 2 per patient (range = 1-3) and occurred within 38-49 days post-operatively. Median time to feed initiation post dilation was 3 days. One patient developed an anastomotic leak after dilatation that required prolonged antibiotic course but no re-operation.

Conclusion: Four of six (67%) SBS patients with post-operative bowel strictures were successfully treated with balloon dilatation avoiding repeat laparotomy and further bowel resection. Balloon dilatation is less invasive than re-operation, preserves bowel length and reduces time to re-initiation of enteral feeding.

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Beyond traditional growth charts: a more granular understanding of pediatric growth through analytic morphomics

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Purpose: Analytic morphomics is used to identify 3-D biologic measures with superior clinical utility and risk stratification over traditional factors such as age, height and weight. The purpose of this study is to define the range of normal with age and gender specific pediatric reference analytic morphomics population (PRAMP™) growth charts.

Methods: The study population contains 2700 individual CT scans of males and females from 1 to 20 years, obtained secondary to trauma or appendicitis. Psoas cross-sectional area, visceral fat area, and trabecular bone density were measured at the L4 vertebral level. We compared this population to the traditional CDC growth chart. Statistical analyses were performed using R with package quantreg growth to determine curves through non-parametric quantile regression.

Results: Growth curves were constructed at the 5th, 25th, 50th, 75th, and 95th quantiles for each variable. Psoas cross-sectional area increases until late adolescence. Trabecular bone density remains stable until adolescence, decreases during adolescence, and increases in young adulthood. Visceral fat area increases over time, with greater variation among late adolescents. The study population was similar to the population used for CDC growth charts.

Conclusion: With this largest cohort of presumed US healthy children to date, this PRAMP™ representative data has been used to construct age- and sex-specific growth curves. It describes markers of muscle strength, bone density, and body composition with intent to capture markers of physical function and chronic health. This may be used in efforts to create unique risk-categorization algorithms specific to particular clinical and global health investigations.

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AVATAR: applying vacuum to accomplish reduced wound infections in laparoscopic pediatric surgery

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Purpose: We previously reported in a retrospective cohort study that applying vacuum to wound dressings can reduce umbilical wound infections after single incision laparoscopic surgery. The aim of this study was to test the same principle in pediatric laparoscopic surgery in a randomized controlled clinical trial.

Methods: We obtained approval from our human ethics review board and obtained consent from all patients. We performed a power calculation informed by our pilot study and randomized all pediatric patients undergoing laparoscopic surgery to receive a standard umbilical wound dressing or the same dressing with vacuum applied. A nurse blinded for the treatment arm diagnosed surgical site infections using the American Center for Disease Control criteria 7-10 after surgery. We compared data with a Fisher exact test and defined p<0.05 as significant.

Results: Demographic data between the two groups were comparable. We recruited 90 patients over a 2-year period; 35 were randomized to the vacuum dressing and 30 to the control dressing. We observed a 2.8% (n=1) infection rate in the vacuum dressing group and 3.3% (n=1) in the control group (p = 1.0).

Conclusion: The low infection rate observed in both groups during the interim analysis after two years informed us that an impractical large number of patients would be required to achieve sufficient power in this trial, and therefore, the trial was ended. We observed a trend towards lower umbilical wound infections when vacuum was applied to the dressing after laparoscopic surgery.

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Less rigorous brace protocol for pectus carinatum

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Purpose: Despite the widespread use of bracing to correct pectus carinatum (PC) there is no consensus in the number of hours per day patients are instructed to wear the brace. In our practice, we use a less rigorous protocol of 8-12 hours/day while others instruct wearing it up to 24 hours/day. We sought to evaluate our results and those in the literature to determine whether more intensive usage is necessary and if it affects patient compliance.

Methods: We reviewed the outcomes of all patients with PC treated at our institution between January 2012 and July 2015. We searched CENTRAL, MEDLINE, EMBASE and PubMed for studies describing the use of bracing to correct PC.

Results: A total of seventy five patients presented with PC at our institution and were offered bracing to wear for 8-12 hours/day. Among patients who had adequate follow-up, success rate (full correction or showing improvement) was 90.6%. The compliance rate was 93.8%. We identified fifteen studies that met our inclusion criteria. Our pooled data combining our results with those of other published data showed that studies featuring less intensive brace usage (<12 hours/day), when compared to studies with more intensive usage (>12 hours/day), were associated with higher patient compliance (88.8% vs 81.1%) with a similar time to correction (7.3 vs 7.1 months).

Conclusion: Our data demonstrates that implementing a less rigorous bracing protocol (8-12 hours/day) for children with PC achieves satisfactory correction with improved compliance rates.

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Atropine treatment for hypertrophic pyloric stenosis: a systematic review and meta-analysis

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Purpose: Atropine has been reported as an alternative to pyloromyotomy in infants with hypertrophic pyloric stenosis (HPS). Our aims were to review the efficacy of atropine in treating HPS and to compare Atropine treatment vs. pyloromyotomy.

Methods: Using a defined search strategy, two investigators independently identified studies reporting atropine treatment for HPS. Case reports and opinion articles were excluded. Outcome measures included success rate, side effects and length of hospital stay. Maneuvers were compared using Fisher's Exact Test and meta-analysis was conducted using RevMan-5.3. Data are expressed as mean±SD.

Results: Systematic review - Of 48 abstracts screened, 21 full-text articles were analyzed (no prospective or randomized studies). Eleven articles (321 infants) reported HPS resolution using Atropine in 254 (79%) patients. Atropine side effects, documented in 34/254 (14%) infants, included tachycardia, increased transaminases, and flushed skin. Meta-analysis - three studies compared atropine treatment (87 infants) with pyloromyotomy (79 infants). Pyloromyotomy had higher success rate (100%) than atropine (82%, \(p<0.01\); Figure). Moreover, patients treated with pyloromyotomy had shorter hospital stay (3.8±1.6 days) than those treated with atropine (9.1±5.4d; \(p<0.0001\)).

Conclusion: Currently, there is no evidence-based support for atropine treatment in infants with HPS. Comparative studies indicate that atropine is less effective than pyloromyotomy in HPS. We recommend atropine treatment for infants with HPS who are unfit for general anesthesia or surgery.

**Success rate**

<table>
<thead>
<tr>
<th>Study name</th>
<th>Odds ratio</th>
<th>Lower limit</th>
<th>Upper limit</th>
<th>Z-Value</th>
<th>p-Value</th>
<th>Odds ratio and 95% CI</th>
</tr>
</thead>
<tbody>
<tr>
<td>Yarrataka A et al (2000)</td>
<td>0.122</td>
<td>0.005</td>
<td>2.753</td>
<td>-1.323</td>
<td>0.186</td>
<td></td>
</tr>
<tr>
<td>Kawahara H et al (2005)</td>
<td>0.075</td>
<td>0.004</td>
<td>1.353</td>
<td>-1.755</td>
<td>0.079</td>
<td></td>
</tr>
<tr>
<td>Lukac Met al (2013)</td>
<td>0.055</td>
<td>0.003</td>
<td>0.981</td>
<td>-1.973</td>
<td>0.048</td>
<td></td>
</tr>
</tbody>
</table>

![Graph comparing success rate](image)
**Improving access and value for families: the pediatric surgery telehealth program**

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**Purpose:** Access to specialized child health services is critical to population health. In Canada, access to subspecialty surgical services for children imposes inconvenience and financial hardship on geographically remote families. The purpose of this study was to evaluate a recently implemented, pediatric surgical telehealth (TH) pilot program from the family and provider perspective, as well as its impact on specialty-specific consultation wait times.

**Methods:** Enabled by an existing TH infrastructure for pediatric subspecialty medicine and mental health, a pilot TH program for surgical consultation was established by a single surgeon. Following establishment of eligibility criteria, remote patients requiring either new consultation or clinical follow-up were offered a TH alternative. Patient demographic (diagnosis, home postal code) and satisfaction questionnaires, cost-avoidance estimates and pediatric surgery consultation wait time (W1) data were analyzed.

**Results:** A total of 40 patients (28 new, 12 follow-up) were seen in 6 remote TH centers. Amongst new referrals, the commonest diagnosis was chest wall deformity, and the average travel distance avoided was 443km, with an estimated direct cost avoidance of $578. 100% of families indicated a high degree of overall satisfaction with the TH experience. Provider satisfaction was similarly high, from the technology user interface and clinical effectiveness perspectives. Overall pediatric surgical consultation wait times were unaffected.

**Conclusion:** Introduction of TH technology to a pediatric surgical practice offers high value to remote patients and their families. This technology, broadly applied, has the potential to reduce surgical wait times for children by increasing overall system capacity.

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Evaluation of a checklist for the improvement of informed consent process in pediatric surgery

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Purpose: Checklists standardize processes and improve patient safety. A checklist to improve consent process for surgical procedures has not been developed. We aim to assess and improve the consent process for pediatric surgery by developing and validating such a checklist.

Methods: A checklist for informed consent was created following a literature search. We utilized a pre- and post-intervention design. During both phases, consent processes were observed from general surgery (GS) and urology (US). The intervention consisted of an education session on the checklist and its insertion in the pre-operative paperwork. Patients/guardians were asked to complete a questionnaire evaluating their satisfaction with the consent process in both phases. Results were analyzed using Chi Squared and independent student T tests. Both teams were interviewed exploring the value of the checklist.

Results: 73 and 66 observations were made in the pre and post-intervention phase. We had a patient/guardian satisfaction survey response rate of 97.8%. 14 interviews were conducted. Our checklist improved the frequency of explanations in multiple domains but did not change the patients'/guardian’s satisfaction with the process or alleviate their anxiety (table 1). Trainees found the checklist more valuable than staff surgeons.

Conclusion: Our checklist improved and standardized vital components of the pediatric surgery informed consent process and could be used as a training tool for trainees.

Table 1:

<table>
<thead>
<tr>
<th>Findings</th>
<th>Pre intervention</th>
<th>Post intervention</th>
<th>P value</th>
</tr>
</thead>
<tbody>
<tr>
<td>Explained alternative treatments</td>
<td>23.3%</td>
<td>81.8%</td>
<td>&lt;0.001</td>
</tr>
<tr>
<td>Explained consequences of not pursuing surgery</td>
<td>60.3%</td>
<td>87.9%</td>
<td>&lt;0.001</td>
</tr>
<tr>
<td>Explained role of trainees</td>
<td>15.1%</td>
<td>72.7%</td>
<td>&lt;0.001</td>
</tr>
<tr>
<td>Patients’/Guardians’ satisfaction</td>
<td>3.54</td>
<td>3.67</td>
<td>0.329</td>
</tr>
<tr>
<td>Patients’/Guardians’ anxiety</td>
<td></td>
<td>X² = 2.89</td>
<td>0.41</td>
</tr>
</tbody>
</table>
Pyloromyotomy: Is it safe to do after 3 pm?

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Purpose: OR flow and patient wait times are significant issues in most hospitals. Pyloromyotomy is one of the most common procedures in pediatrics. It’s generally performed only during business hours due to perceived increased risk of surgical or anesthetic complications. The purpose was to determine the surgical and anesthetic complication rate of pyloromyotomy performed both during and after business hours.

Methods: A review of 255 patients who underwent pyloromyotomy 2010-2012, was performed. 192 (75.3%) underwent surgery between 7 am-3 pm (business hour group, BHG) including 177 laparoscopic and 15 open procedures. 63 (24.3%), had surgery after 3 pm (after hours group, AHG). This included 51 laparoscopic and 12 open pyloromyotomies. Thirty day outcomes were reviewed.

Results: Demographics and preoperative wait times were similar between the two groups. Mean hospital stay was 2.77 ± 2.47 days for BHG and 2.30 ± 1.23 days for AHG (p<0.05). The BHG group had a significantly higher complication rate (n=28, 14.6%) compared to AHG (n=6, 9.5%) (p<0.0001). Patients undergoing laparoscopic pyloromyotomy had a higher complication rate in BHG (n=21, 10.9%) versus AHG (n=9, 5.5%) (p=0.0114). No difference existed between the two groups anesthesia complication rates and patients undergoing open procedures. Readmission rates were higher in BHG (n=11, 5.7%) versus AHG (n=2, 3.1%) (p=0.0001). No mortality was seen in either group.

Conclusion: No temporally dependent differences in surgical or anesthetic complication rates were identified between the two groups. Pyloromyotomy may be safely performed at any time, which will improve patient flow, decrease preoperative wait and decrease hospital length of stay.

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Variability of surgical technique for children with biliary atresia in Canada: is it time for standardization?

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Purpose: The reported Canadian 4-year native liver survival rate after Kasai portoenterostomy (KP) is 39%, lower than in some countries where biliary atresia (BA) management is standardized. The Canadian biliary atresia registry (CBAR) collects prospective data to achieve consensus on best practices. In this first CBAR study, we examined variability of surgical technique when performing a KP.

Methods: Important technical steps, surgical options and surgical consensus regarding KP were identified from the literature. With REB approval, surgeons in all Canadian centers were invited to complete an online survey of their KP operative technique.

Results: Surveys were completed by 32 pediatric surgeons from 11 centres, representing about half of all practicing Canadian pediatric surgeons. Most centres do not use a standard surgical protocol and 91% of surgeons typically perform an intra-operative cholangiogram. Laparoscopic exploration is done by 16%, but none perform a laparoscopic KP. An extended portal dissection is done by some surgeons, and 78% avoid diathermy at the portal plate. The length of roux-en-y loop used varies from 20-50cm, with both retrocolic and antecolic configurations reported. Most surgeons use 5-0 monofilament absorbable sutures for the porto-enteric anastomosis. Surgical drains are used by 53%.

Conclusion: In Canada, KP is not centralized to designated surgeons, and surgical technique is one variable that may affect the outcomes of BA. Since there are only 20-30 cases of biliary atresia annually in Canada, collaboration through the CBAR may allow introduction and evaluation of standardized medical and surgical protocols to improve outcomes for this rare and serious condition.

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Barriers and facilitators to the implementation of evidence-based practice by pediatric surgeons

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Purpose: To identify barriers and facilitators to the utilization of best research evidence in pediatric surgical practice, using theoretical domains framework (TDF).

Methods: Semi-structured interviews of 14 pediatric surgeons were conducted at the 2015 Canadian Association of Paediatric Surgeons conference. Interviews were guided by the 14 domains of the TDF, an integrative framework that allows for the assessment of health behaviours and associated barriers and facilitators. Data resulting from interviews were analysed using a systematic 3-step approach consisting of coding, generation of specific beliefs, and identification of domains relevant to practice change.

Results: Five of the fourteen domains were identified as relevant to changing pediatric surgeons’ use of best evidence in practice. Important barriers to EBP implementation included time constraints and resource limitations (Environmental Context and Resources domain), the general poor quality of evidence in pediatric surgery (Knowledge), a lack of required skills (Skills), and a cultural that continues to rely on an apprenticeship style of teaching (Social/Professional Role and Identity). Facilitators include working in an institution that generates its own research evidence (Environmental Context and Resource) and has a champion for EBP (Social Influence), and having peers that support EBP implementation (Social Influence). There were conflicting thoughts as to whether working as a group facilitated the use of evidence or impeded it.

Conclusion: We identified barriers and facilitators that pediatric surgeons believe influence the use of research evidence in their practice. This information may be used to inform behaviour change intervention design intended to encourage EBP implementation.

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**Practice patterns in reduction of paediatric intussusception in Canada**

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**Purpose:** Two main methods exist for non-surgical reduction of paediatric intussusception - air and contrast enema. Outside of Canada, surveys find inconsistent treatment practices. Our objective is to understand the non-surgical treatment of paediatric intussusception treatment practices in Canada.

**Methods:** An electronic survey was sent to radiologists at fourteen major paediatric treatment centers in Canada; twelve centers (86%) responded.

**Results:** The majority of centers perform 8-20 reductions per year. The diagnosis is confirmed using ultrasound in eleven of twelve centers. Prior to enema treatment, 75% of centers require a surgical consult, and 67% have a surgical team member present during the reduction attempt. Enema reduction is performed using fluoroscopic guidance in all centers; seven centers use air, three use contrast liquid, and two use either, depending on the radiologist. In centres performing air reduction, only three centers utilize a commercially available Health Canada approved device. Seven of these centers use a manual pump and two use wall gas. One center does not have any safety valve, three have an independent mechanical valve, and three have a hand-operated valve. All devices use analogue pressure displays. No devices are automated. All centers using air attempt to limit intra-colonic pressure to 120mmHg or lower. However, only three centers have a written protocol and none can verify compliance.

**Conclusion:** Across Canada, intussusception treatment protocols are inconsistent or non-existent while equipment is ad-hoc, low-tech and provides no means for quality assurance. Standardizing protocols and modernizing equipment may improve outcomes and increase understanding of treatment.

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Decreased radiographic utilization in dedicated pediatric trauma centers

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Purpose: The primary purpose of this study is to compare the frequency of body imaging in pediatric trauma patients during our transition from a combined adult and pediatric level 1 trauma center to a free-standing pediatric level 2 trauma center. Secondary aims are to evaluate emergency room length of stay.

Methods: All computed tomography (CT) body scans and focused assessment with sonography in trauma (FAST) exams performed in the initial trauma evaluation were compared between the combined (2008–2011) and pediatric hospital (2011–2014). The groups were then case matched by injury severity score (ISS).

Results: A total of 2821 children were evaluated at our combined (n=1630) and pediatric hospital (n=1193). The pediatric hospital performed significantly imaging studies compared to the combined center (Table 1). This significant difference remained after ISS case matching (72% of patients successfully matched). Length of emergency room stay was a median of 3.9 hours (0-13) at the combined versus 3.2 hours (0-17.6) at the pediatric hospital (p= 0.002).

Conclusion: Pediatric trauma patients receive less radiographic utilization at free-standing pediatric trauma center compared to children at combined trauma centers. Pediatric trauma centers are more sensitive to the specific needs of a child resulting in expedited emergency care, minimization of radiographic studies and higher confidence in negative focused assessment with sonography in trauma exams.

Table 1: Outcomes

<table>
<thead>
<tr>
<th></th>
<th>Combined (n=1630)</th>
<th>Pediatric (n=1193)</th>
<th>p-value</th>
</tr>
</thead>
<tbody>
<tr>
<td><strong>Age (years)</strong> *</td>
<td>7.4 (0.02-18)</td>
<td>6.2 (0.01-18)</td>
<td>&lt;0.0001</td>
</tr>
<tr>
<td><strong>Injury Severity Score</strong> *</td>
<td>8 (0-75)</td>
<td>4 (1-54)</td>
<td>&lt;0.0001</td>
</tr>
<tr>
<td>Any CT body</td>
<td>21%</td>
<td>17%</td>
<td>&lt;0.01</td>
</tr>
<tr>
<td>CT chest</td>
<td>17%</td>
<td>11%</td>
<td>&lt;0.001</td>
</tr>
<tr>
<td>CT abd/pelv</td>
<td>19%</td>
<td>10%</td>
<td>&lt;0.001</td>
</tr>
<tr>
<td>CT thoracic/lumbar spine</td>
<td>15%</td>
<td>11%</td>
<td>&lt;0.001</td>
</tr>
<tr>
<td>FAST</td>
<td>18%</td>
<td>14%</td>
<td>&lt;0.01</td>
</tr>
<tr>
<td>CT body and FAST</td>
<td>36%</td>
<td>18%</td>
<td>&lt;0.0001</td>
</tr>
<tr>
<td>CT abd/pelv after (-) FAST</td>
<td>44%</td>
<td>34%</td>
<td>&lt;0.02</td>
</tr>
</tbody>
</table>

*Median (range), CT= computed tomography, Abd/pelv= abdomen/pelvis, FAST= focused assessment with sonography in trauma

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Pediatric surgical workforce and training in Africa: current status and future needs

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Purpose: Pediatric surgical (PS) care in Africa faces multiple challenges, and information regarding existing resources and burden of disease is limited. We surveyed available resources and clinical and educational needs of pediatric surgeons in Africa.

Methods: Members of the Pan-African Pediatric Surgical Association (PAPSA) and the Global Pediatric Surgery Network (GPSN) completed a structured 96-item email survey covering PS providers, facilities, resources, workload, education/training, disease patterns, and collaboration priorities.

Results: Out of 285 sent surveys, 84 were completed (34%) from 23 African countries. PS provider density per million people averaged 2.2 general surgeons and 1 pediatric surgeon (0.7 public and 0.3 private). Trained and untrained non-surgeons performed PS in 39% and 33% of participating countries, respectively. Facilities/million averaged 0.1 pediatric hospitals, 0.1 pediatric ICUs, 0.2 neonatal ICUs, and 0.3 pediatric surgical wards. TPN was available in 50% of surveyed countries, frozen section pathology in 40%, neonatal ventilation in 91%, and fluoroscopy in 74%. Median workload was 932 procedures/year/institution (80% major, 65% elective, 30% on children <1 year). Average waiting time was 111 days for elective procedures and 14 days for emergencies. Estimated mortality rates for most index conditions were high (e.g. neuroblastoma 54%, esophageal atresia and rhabdomyosarcoma 45%). Countries averaged 4.5 training programs in general surgery and 1 in PS. Providers ranked collaborative professional development highest and clinical visiting teams lowest priority.

Conclusion: The broad deficits identified in PS human resources, facilities and training in Africa suggest the need for a global comprehensive collaborative effort for addressing the gaps within PS.

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Does conception using assisted reproductive technologies (ART) increase the risk of congenital malformations in the offspring after adjusting for subfertility? A systematic review

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Purpose: The etiology of congenital malformations (CMF) is poorly understood. It has been suggested that conception using ART is associated with higher rates of CMF. In this systematic review, we compare the rates of CMF in ART-conceived singletons to those conceived spontaneously by infertile/subfertile couples.

Methods: A comprehensive search strategy was development for PubMed, EMBASE, Cochrane Library and the grey literature. Two independent reviewers assessed the eligibility of relevant studies using predefined inclusion and exclusion criteria. Included articles underwent critical appraisal using a risk of bias framework and a sensitivity analysis was conducted on studies with a low risk of bias. Absolute numbers and crude or adjusted odds ratios (OR) of CMF for each group were extracted. Random effects meta-analysis was used to analyze the data.

Results: From 1044 articles, 30 full-text publications were reviewed. Six studies were included in the final analysis. When only three studies with a low risk of bias were analyzed, the pooled OR remained non-significant [1.11 (0.98-1.25)] with 0% heterogeneity (see table).

Conclusion: Among subfertile/infertile couples there appears to be no increased risk of CMF in offspring conceived with ART over those conceived spontaneously. The higher rate of CMF suggested in previous studies may be confounded by subfertility factors present in the parents.

Table 1

<table>
<thead>
<tr>
<th>Study or Subgroup</th>
<th>ART Events Total</th>
<th>Non-ART subfertile Events Total</th>
<th>Weight</th>
<th>Odds Ratio M-H, Random, 95% Cl</th>
<th>Odds Ratio M-H, Random, 95% Cl</th>
</tr>
</thead>
<tbody>
<tr>
<td>Davies 2012</td>
<td>392 4846</td>
<td>14 1906</td>
<td>38.0%</td>
<td>1.08 [0.88, 1.31]</td>
<td></td>
</tr>
<tr>
<td>Seggers 2012</td>
<td>20 122</td>
<td>14 86</td>
<td>2.7%</td>
<td>1.01 [0.48, 2.13]</td>
<td></td>
</tr>
<tr>
<td>Zhu 2006</td>
<td>307 4588</td>
<td>344 5764</td>
<td>59.3%</td>
<td>1.13 [0.96, 1.32]</td>
<td></td>
</tr>
<tr>
<td>Total (95% CI)</td>
<td>9556</td>
<td>7756</td>
<td>100.0%</td>
<td>1.11 [0.98, 1.25]</td>
<td></td>
</tr>
<tr>
<td>Total events</td>
<td>719</td>
<td>502</td>
<td></td>
<td></td>
<td></td>
</tr>
</tbody>
</table>

Heterogeneity: Tau² = 0.00; Chi² = 0.20, df = 2 (P = 0.91); I² = 0%

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The surgical management of intestinal malrotation: a Canadian Association of Paediatric Surgeons survey

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Purpose: Some surgeries are now performed almost exclusively via a laparoscopic approach to enhance recovery and reduce post-operative complications. This survey explored institutional and individual physician practice patterns of the surgical management of malrotation.

Methods: All 2015 Canadian Association of Pediatric Surgeons annual meeting attendees were invited to complete an anonymous pre-piloted survey. Descriptive statistics were calculated.

Results: The response rate was 35% (150 distributed, 52 returned). Most institutions (39.5%) saw, on average, 5-10 cases of malrotation per year. Most respondents (54.2%) indicated that the laparoscopic (LL) and open Ladd’s (OL) procedures were equal surgical approaches for stable patients. Respondents were nearly equally divided (47.9% yes; 44.7% no) with respect to whether a LL procedure led to a higher risk of post-operative volvulus. Of those who answered yes, most indicated that an increased risk of post-operative volvulus was due to an inadequate widening of mesentery (45.8%), reduced “beneficial” post-operative adhesions (29.2%), or both (16.7%). 100% of respondents who perform an OL as their standard procedure indicated that there was a higher risk of post-operative volvulus with LL procedure. Only 1/8 who performed a LL as a standard approach routinely performed an appendectomy.

Conclusion: There remain polarized views on the best surgical approach to malrotation yet a persistent belief in the reduction in post-operative adhesions in leading to a post-operative volvulus with LL procedures. Collaboration to permit long-term follow-up of a large cohort may help develop guidelines for the operative management of malrotation.

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Why so late? Barriers to timely access to pediatric surgical care at Mbarara Regional Referral Hospital, Uganda

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Purpose: Outcomes in pediatric surgery are dependent on timely access to care. This study aimed to identify and quantify delays in patient referral and treatment for congenital anomalies, pediatric tumours, and hernias in Mbarara, Uganda.

Methods: Pediatric surgical referrals and operative interventions were retrospectively collected at Mbarara University Teaching Hospital during 2014. Delays were classified using the 3-delay model into care seeking (Type 1), arrival at health facility (Type 2), and provision of definitive care (Type 3). Average age of referral (surrogate for Type 1 + 2 delays) and wait time from referral to definitive surgery (Type 3 delay) was calculated by diagnosis.

Results: There were 656 outpatient referrals recorded: 357 (54%) for congenital anomalies, 226 hernias (34%) and 73 tumors (11%). Average age of presentation was 2.8 years for congenital anomalies, 4.0 years for hernias, and 6.2 years for tumours. Matched definitive care delays were determined for 63 patients. Average delay to surgery was 25 days (range 0-166) for congenital anomalies, 36 days (3-166) for hernias, and 17 days (2-200) for patients with abdominal tumours.

Conclusion: Pediatric surgical patients in Mbarara, Uganda face significant delays in obtaining definitive surgical care for congenital anomalies, hernias, and tumours. Delays in care-seeking and arrival to health facilities play a significant role, as reflected by the advanced age at first presentation. Surgical wait times are typically short but vary widely. A prospective study is planned to identify the contributing factors and their relative contribution for each type of delay.

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High prevalence of same-sex twins in patients with cloacal exstrophy: support for embryological association with monozygotic twinning

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Purpose: Previous studies have hypothesized that cloacal exstrophy may be caused by errors early in embryological development related to monozygotic twinning. This study reports the prevalence of twins in a large cohort of patients with cloacal exstrophy.

Methods: After IRB approval, the records of 71 patients with cloacal exstrophy treated 1974-2015 were reviewed and reports of multiple gestation or conjoined twinning were noted. The genetic sex of the affected patient and their twin, and any mention of anomaly in the twin were recorded. Neither placental exam nor genetic testing results were available to definitively determine zygosity. The rate of twin births was compared with the general population using an exact binomial test.

Results: Of 71 patients, 10 had a live born twin (14%), all of whom were of the same genetic sex as the affected patient. One additional patient’s twin suffered intrauterine fetal demise, and another patient had a conjoined non-viable twin. None of the twins were affected by exstrophy-epispadias complex. The rate of twin birth in this cohort was significantly higher than that seen in the general population during this time period (P<0.001), with rate approximately 4.4-7.7 times that reported by the Centers for Disease Control, and a striking preponderance of same-sex pairs.

Conclusion: The highly significant prevalence of same sex twin pairs within this cohort supports the hypothesis that cloacal exstrophy may be due to errors early in embryogenesis related to the monozygotic twinning process.

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A mixed-methods review of pediatric surgical safety checklists

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Purpose: The pediatric surgical chiefs of Canada believe that a surgical safety checklist (SSC) is important for patient safety but requires a tailored approach in children. This mixed-methods review analyzes modifications of pediatric SSCs and describes published evidence of SSC effectiveness.

Methods: A comprehensive search identified studies of pediatric SSCs. Independent paired screening of titles, abstracts and full-texts identified papers for extraction. Studies were categorized and important themes identified. SSCs from published studies and non-published Canadian pediatric SSCs were analyzed for modifications using a piloted extraction tool.

Results: Twenty papers were identified. Study purposes included evaluation of clinical outcomes (7/20), compliance (10/20), barriers (3/20), and attitudes (10/20). 16/20 Studies described implementation with stakeholder involvement in 8/20 studies. Observations across studies include: Surgical team members believe that the SSC is important for patient safety but evidence for impact on clinical outcomes is lacking; compliance may not reflect implementation fidelity, which is harder to achieve; implementation strategies involving stakeholders and integrated into quality improvement initiatives may be most effective; Parental involvement in the pediatric SSC may improve the perceived utility of the SCC in contributing to patient safety. Close to a third of pediatric SSCs include parental involvement. Many SSCs have an extensively modified sign-in and a different approach for higher risk cases.

Conclusion: Surgical teams and parents of children undergoing surgery believe that the SSC is important for patient safety. Pediatric SSCs may require a tailored approach, especially for complex cases, and may be more effective when integrated into a larger quality improvement initiative.
Prenatal diagnosis and outcome of fetal gastrointestinal obstructions

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Purpose: To evaluate the accuracy of prenatal diagnosis and outcome for fetuses with gastrointestinal (GI) obstructions.

Methods: A retrospective review of fetuses diagnosed with GI obstruction (excluding esophageal and duodenal) from 2006 to February 2016 was conducted at a fetal tertiary care center. Prenatal diagnosis and fetal imaging studies were compared to postnatal findings. Diagnostic accuracy (DA), rate of other anomalies (OA), discharge on TPN (D/C TPN), length of stay (LOS), short bowel, discharge with gastrostomy, and survival were evaluated.

Results: Forty-eight patients were diagnosed prenatally with GI obstruction; 6 were excluded due to lack of complete records and follow-up. Diagnosis was based on fetal MRI and US in 34 fetuses, and US alone in 12. A diagnosis of the specific obstruction was accurate in 88.1% (n=37/42) with positive predictive value of 91.3%. Diagnostic accuracy of MRI was 84.4%. Postnatal outcomes and diagnostic accuracy of individual diagnoses are shown in figure 1. Four fetuses seen in our fetal center had a GI obstruction diagnosed postnatally (not appreciated prenatally).

Conclusion: Fetal MRI is an accurate modality in the diagnosis of fetal GI obstruction. Fetuses diagnosed with rectal obstruction have higher mortality, associated with a high-rate of other anomalies.
Figure 1

Legend:
DA: Diagnostic accuracy
OA: Other anomalies

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Hepatic hemangiomas: infantile or congenital: how do you know?

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Purpose: Infantile hemangiomas (IH) present shortly after birth and have a proliferative period and undergo subsequent involution. Congenital hemangiomas (CH) are fully formed at birth and may undergo variable involution.

Methods: A retrospective review of all pediatric hepatic hemangioma patients between 2005 and 2014. Demographic data, radiology and clinical course were reviewed. Univariate and multivariate analyses were performed.

Results: 48 patients had hepatic hemangioma 30 with IH, and 18 with CH. No difference was noted between in gender, gestational age, race or thyroid abnormalities. Hepatic lesions were diagnosed earlier in IH with at a median age of 1 month (0-7mo)) and 2 months in CH (prenatal-216mo) (p<0.05). All patients with IH were asymptomatic. 3 patients with CH were symptomatic with abdominal compartment syndrome and cardiopulmonary distress. The median size of the lesion in CH 19mm (7-100mm) and 9mm in IH (1.4-73mm) (p< 0.03). IH patients were more likely to have multiple lesions (83.34%, versus 22.22%, p< 0.005). The rate of decrease in size in the first year of life was 77.78% in IH and 33.33% in CH (p< 0.004). The median time to complete resolution of lesions was 19 months (7-60 months) and 21months (12-67 months) in CH patients.

Conclusion: IH patients at presentation were more likely to be younger, asymptomatic at diagnosis, have multiple small lesions and cutaneous lesions. IH lesions resolved more rapidly than patients with CH. CH patients presented with larger lesions and were more often symptomatic. Understanding findings at presentation can help plan treatment and determine prognosis for these patients.

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The distribution of gastroschisis in Manitoba

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Purpose: There is an alarming increase in the prevalence of gastroschisis (GS) globally according to multiple recent reports. In addition, geographical variation and clusters of GS have been identified in the current literature. The etiology of this increase is largely unknown at this time. Our aim was to investigate if this disparity in incidence existed in the province of Manitoba.

Methods: We conducted a retrospective cohort study between 2004 and 2011 in the only 2 referral centres in the province of Manitoba. Cases of GS were identified using ICD 9/10 codes. Incidence rates of GS were calculated from published regional birth rates and spatial distributions were compared between regions.

Results: In 2005 cases of GS were 6-fold higher in northern Manitoba compared to Winnipeg (70 per 100,000 vs 454 per 100,000) and increased by 90% (869 per 100,000) compared to only 30% in Winnipeg (92 per 100,000) (Table 1).

Conclusion: We identified an increasing incidence of GS throughout Manitoba from 2004 - 2011 with a disproportionate ratio in the Northern regions. This is the first paper to identify a “hot spot” in Canada. Although many of the clearly identified risk factors are present in these populations, they may possess additional characteristics that predispose these regions to an increased prevalence of this structural developmental defect. It raises many questions upon which to build possible future research, interventions and preventative strategies to address this issue.
TABLE 1: Rates of GS relative to birth rates in Winnipeg vs Northern Manitoba

<table>
<thead>
<tr>
<th>Year</th>
<th>GS / Live births Winnipeg</th>
<th>GS / Live Births Northern Manitoba</th>
</tr>
</thead>
<tbody>
<tr>
<td>2004</td>
<td>2 / 6950</td>
<td>1 / 220</td>
</tr>
<tr>
<td>2005</td>
<td>5 / 7130</td>
<td>1 / 220</td>
</tr>
<tr>
<td>2006</td>
<td>5 / 7225</td>
<td>1 / 205</td>
</tr>
<tr>
<td>2007</td>
<td>9 / 7465</td>
<td>1 / 245</td>
</tr>
<tr>
<td>2008</td>
<td>6 / 7505</td>
<td>2 / 250</td>
</tr>
<tr>
<td>2009</td>
<td>7 / 7805</td>
<td>3 / 250</td>
</tr>
<tr>
<td>2010</td>
<td>9 / 7675</td>
<td>2 / 255</td>
</tr>
<tr>
<td>2011</td>
<td>7 / 7530</td>
<td>2 / 230</td>
</tr>
</tbody>
</table>

TABLE 2: Rates of total GS in Manitoba 2004-2011

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Cervical spine imaging for young children with inflicted trauma: expanding the injury pattern

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Purpose: The aim was to document the incidence and pattern of cervical spine (c-spine) injuries in children younger than 36 months with confirmed inflicted trauma.

Methods: After IRB approval, a prospective cohort study was performed. Data were collected between July 2011 and January 2016. Inclusion criteria were: age below 36 months, loss of consciousness after inflicted trauma, and one of the following on initial head computed tomography (CT): subdural, intraventricular, intra-parenchymal, subarachnoid hemorrhage, or cerebral edema. An imaging protocol of brain and neck magnetic resonance imaging (MRI) and MR angiography was obtained within 48 hours of admission. Clinical variables, imaging findings and outcomes were recorded. Variables were compared by t-test and Fisher-exact test.

Results: 52 were included (median age: 5 months; range: 1-35 months), 37 were male (71%) and 7 died (13.4%). C-spine injury was identified in 7 (13%), and included ligamentous injury (2), vertebral artery shear injury (1), atlanto-occipital dissociation (1), cord injury with cord epidural hematoma (2) and isolated cord epidural hematoma (1). Retinal hemorrhages (p=0.04), lower Glasgow coma score (GCS) (p=0.01), and a higher incidence of brain infarcts at 48 hours (p=0.01) were significantly associated with C-spine injury. One died and 5 had significant disability.

Conclusion: After institution of an imaging protocol for small children with inflicted trauma, the incidence of C-spine injuries is 13%. An injury pattern of retinal hemorrhages, lower GCS, brain infarction and c-spine injury is identified. The evaluation of shaken infants should include non-ionizing cross-sectional c-spine imaging as the incidence of ligamentous and nervous injury is significant.

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Outcomes of an accelerated care pathway for pediatric blunt solid organ injuries in a public healthcare system

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Purpose: An accelerated clinical care pathway for solid organ abdominal injuries was implemented at a level-one pediatric trauma centre to standardize early mobilization, blood work, ICU admission and discharge from hospital. The objective of this study was to assess impact on resource utilization and demonstrate protocol safety.

Methods: With ethics board approval, data was collected retrospectively on consecutive patients admitted with blunt abdominal solid organ injuries (spleen/liver/kidney) from 2012-2015. Patients were subdivided into pre- and post-protocol groups. No exclusion criteria were instituted. Length of hospital stay (LOS) was determined a priori as the primary outcome of interest.

Results: 138 patients with solid organ injury were admitted to hospital; 73 pre-protocol (2012-2013) and 65 post-protocol (2014-2015). There were no significant baseline differences between groups including age, sex, injury severity score (ISS), injury grade or mechanism (p > 0.05). LOS was significantly shorter post-protocol (median 5.0 vs. 3.0 days; p = 0.0002); resulting in an average cost savings of $5966 per patient. Time to mobilization was shorter in the protocol group (p<0.0001) and these patients experienced fewer blood draws (p=0.02). On multivariate analysis, post-protocol group (p<0.001) and lower ISS (p<0.001) were predictive of shorter LOS. There were no differences in surgical interventions, embolizations, or blood transfusions. There were no mortalities or re-admissions to hospital within 30 days.

Conclusion: An accelerated care pathway is safe and effective in the management of pediatric solid organ injury resulting in less blood draws, faster return to activity and decreased length of stay without significant morbidity and mortality.

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Tunneled central venous catheter in children with malignant disease: comparison of open to percutaneous implantation

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Purpose: Tunneled central venous catheters (tCVC) are routinely used for long-term venous access in children with cancer. These could be inserted either by surgical venous cut-down or percutaneously. The aim of this study is to compare operative time and intraoperative complications of surgical vs. percutaneously implanted tCVC’s.

Methods: Retrospective study was performed comparing patient group A (surgical venous cut-down, years 2002-2006) with patient group B (percutaneous, years 2008-2012). Patient characteristics, operative time and intraoperative complications were obtained from surgical reports. Position of the implanted tCVC was checked at X-rays.

Results: We included 337 patients in group A and 318 patients in group B. Age at implantation (0-17 years) and underlying diagnoses were similar in both groups. Indications for implantation of tCVC were leukemia, solid tumors and central nervous system tumors. Operation time was significantly shorter in percutaneous approach. Only 56% of the primarily dissected veins were suitable for implantation, whereas successful vessel puncture was possible in 80% in the first attempt (16% in the second). Change from percutaneous implantation to open surgical approach was necessary in 6% of the cases. Bleeding occurred in 2% of the cases with surgical approach, pneumothorax occurred in 1.8% in the percutaneous cases. Early catheter dislodgement was significantly higher after open approach.

Conclusion: Percutaneous implantation of tCVC is safe, less invasive and faster compared to surgical approach in children of all age groups with malignant diseases. Complication rate is low. Limitation of the study is the retrospective design.

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Non-randomized assessment of ingrown toenails treated by excision of the skinfold rather than toenail (NAILTEST): a prospective study of the Vandenbos procedure

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Purpose: To assess the morbidity, functional outcomes, and patient satisfaction with the Vandenbos procedure for ingrown toenails. This technique involves excising the soft tissue around the affected nail and allowing the skin to heal by secondary intention. Previous studies have documented low rates of recurrence but patient-reported outcomes remain uncertain.

Methods: This study was a prospective, observational assessment of children, adolescents, and young adults undergoing the Vandenbos procedure for one or more ingrown toenails. After IRB approval (#104906), standardized assessments of functional status and quality of life were completed before surgery and then one, two, and six months post-operatively. Patient satisfaction was captured at six months using a standardized questionnaire.

Results: Thirty-six participants (age range 4-20 years) completed at least one post-operative assessment and were included in the analysis. The Vandenbos procedure was associated with significant improvements on the visual analogue scale (p=0.001) and European quality of life instrument (p<0.05). All participants were able to wear normal footwear within one month of surgery. Minor complications included bleeding (8.3%), post-operative pain (8.3%), and infection (2.8%). There were no reoccurrences during the study period. Mean overall score on the patient satisfaction questionnaire was 87 out of 100. 90% of all participants reported that they would recommend the Vandenbos procedure to a friend or family member.

Conclusion: We conclude that the Vandenbos procedure is associated with a low recurrence rate in children, adolescents, and young adults with ingrown toenails. While this technique may appear radical and invasive, recovery time, functional outcomes, and patient satisfaction are excellent.

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Injury severity in pediatric all-terrain-vehicle related trauma in Nova Scotia

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Purpose: In 2004-2005, legislation restricting all-terrain vehicle (ATV) use by children and an extensive public awareness campaign intended to reduce pediatric ATV related morbidity. We aim to compare the frequency, nature and severity of pediatric ATV associated trauma before and after such interventions.

Methods: A retrospective chart review of pediatric ATV related trauma in Nova Scotia from 1998-2014 was performed (n=191). National databases were queried for provincial hospitalizations (n=258); level I pediatric trauma center emergency department (ED) visits (n=342) and hospitalizations (n=136); and ATV sales from 2002-2014. Admissions between 1998-2003 and 2006-2014 were compared using Chi Square analysis to determine age distribution (<14 vs. 14-15 years old), mechanism of injury (rollover vs. other), helmet use and injury severity score (ISS) (≤9 vs. >9).

Results: Admissions and sales decreased following legislative change for a period of 4 years and then gradually increased. Admissions during the post legislative era showed statistically significant higher proportion of rollovers (p=0.0092), however there was no difference in age distribution (p=0.6018), helmet use (p=0.2792) or injury severity (p=0.5522).

Conclusion: Implementation of restrictive legislation coupled with public awareness was associated with an initial decrease in ATV related hospitalizations however that effect was not sustained over time. Although rollovers were more frequent, the severity of injuries was unchanged.
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Compliance with evidence-based guidelines for computed tomography of children with head and abdominal trauma

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Purpose: Prospective clinical trials have resulted in guidelines for children at very low risk for clinically important traumatic brain injuries (ciTBI) or abdominal injury for whom CT is unnecessary. The purpose of this study was to assess compliance at a level one pediatric center with these guidelines as a tool for quality improvement (QI).

Methods: Records of children admitted to our pediatric trauma center were reviewed before and after publication of head (Kuppermann ’09) and abdominal trauma (Holmes ’13) CT imaging guidelines. Data collected included indication for imaging based on guidelines from the prediction rule including history, symptoms, and physical exam findings.

Results: 296 records were reviewed. ISS was similar in both groups before and after guideline publication. Prior to publication of head trauma imaging guidelines, 26.4% of patients reviewed had no indication for imaging compared to 24.1% after publication (p=0.9). Prior to publication of abdominal trauma imaging guidelines, 29% of patients reviewed had no indication for imaging compared to 32% after publication (p=0.9). The rate of ciTBI requiring intervention was 4.6% before and 1.1% after guideline publication (p=0.4). The rate of abdominal injury requiring intervention was 7.9% before and 1.8% post-guideline publication (p=0.2). None of the children at very low risk for abdominal injury or ciTBI required surgical intervention.

Conclusion: At our institution compliance with guidelines for CT of children with head and abdominal trauma is poor with a significant number of patients undergoing unnecessary imaging. This provides an opportunity for QI with evidence based methods to reduce unnecessary imaging for trauma.

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Pannexin1 regulates the malignant properties of rhabdomyosarcoma: novel therapeutic implications

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Purpose: Rhabdomyosarcoma is a skeletal muscle-derived soft tissue sarcoma for which an improved therapeutic strategy is needed. Rhabdomyosarcoma cells have lost the ability to terminally differentiate thus proliferating indefinitely. Promoting their re-differentiation or arresting their proliferation is thus a promising therapeutic approach. We have shown that Pannexin1 levels are below detectable limits in undifferentiated myoblasts, but become highly upregulated during their differentiation and indeed promote this process. Here we hypothesize that Pannexin1 levels are down-regulated in rhabdomyosarcoma and their restoration may alleviate its malignant properties.

Methods: With IRB/IACUC approval, Panx1 levels were assessed in 13 paediatric rhabdomyosarcoma tumour specimens. Inducible Pannexin1 over-expressing patient-derived rhabdomyosarcoma cell lines were used to assess the effect of Pannexin1 over-expression in vitro. In vivo mouse models were used to recapitulate the in vitro findings. Student t-test (p<0.05) was utilized for statistical comparisons.

Results: Pannexin1 transcript and protein levels were low in both embryonal and alveolar rhabdomyosarcoma tumour specimens and cell lines similar to that in fetal skeletal muscle tissue and undifferentiated myoblasts, respectively. In vitro functional analyses have revealed that re-introduction of Pannexin1 in rhabdomyosarcoma cell lines significantly inhibited their proliferation and migration. Moreover, re-expression of Pannexin1 prevented rhabdomyosarcoma spheroid formation and growth, and induced cell apoptosis in some rhabdomyosarcoma cell lines. Pre-clinical orthotopic xenograft studies have shown that Pannexin1 over-expression significantly suppresses rhabdomyosarcoma xenograft tumour growth.

Conclusion: Pannexin1 is down-regulated in rhabdomyosarcoma and its over-expression significantly suppresses the malignant properties of this tumour; thus implicating Pannexin1 as a potential novel therapeutic target for rhabdomyosarcoma.

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Exploring a new paradigm for global pediatric surgery training

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Purpose: The current paradigm to support pediatric surgical education for low and middle income countries (LMICs) is to provide it within the LMICs, often in partnership with high income country (HIC) faculty. Training within LMICs makes contextual sense, but may suffer from few or sporadic faculty. Our purpose in this educational experiment was to explore a new training paradigm for LMIC pediatric surgeons in a HIC centre.

Methods: In 2013 an East African pediatric surgical camp afforded our HIC faculty opportunities to work with and evaluate newly graduated LMIC general surgeons wishing to specialize in pediatric surgery. Amongst worthy candidates, one was chosen to do a one year International Pediatric Surgical Fellowship at our HIC accredited pediatric surgical training centre. An educational license, salary and accommodations were arranged. A one-year training curriculum, utilizing competency-based medical education principles, was divided into three phases (Orientation, Core, Consolidation) each with milestones (118 total) to be assessed and achieved. The curriculum was designed to be realizable within the context of the fellow’s home LMIC.

Results: All prescribed milestones plus specialty certification by examination of the College of Surgeons of East, Central and Southern Africa were achieved. The graduated fellow has established a pediatric surgical practice in the home LMIC which includes leadership and teaching roles.

Conclusion: We conclude from this successful training experiment that we should continue to offer these International Pediatric Surgical Fellowships for LMIC candidates as part of our collaborative efforts as a HIC to increase global pediatric surgical service capacity.

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