Obesity prevalence in children and adolescents presenting for surgery: an exploratory retrospective cohort study

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Introduction

Similar to global trends, the prevalence of Canadian children with obesity has risen from about 5% in 1990 to over 12% in 2022 [1]. Childhood obesity is associated with a range of long-term consequences, including type-2 diabetes, hypertension, asthma, sleep-disordered breathing, hyperlipidemia, metabolic-associated steatotic liver disease, and poor mental health [2,3]. The perioperative period may present an opportunity for counselling and intervention. However, the disease burden must be known, and screening, followed by a scalable implementation, must be feasible. This study aims to explore the trend in epidemiological characteristics of our surgical patients regarding obesity.

Methods

With research ethics board approval and waiver of consent, retrospective data were extracted for two cohorts – a 2-year sample of all children undergoing surgery from the implementation date of our electronic medical record (EMR) (2022-02-26 to 2024-02-25) and a 12-year sample of patients included in our hospital's Pediatric National Surgical Quality Improvement Program (P-NSQIP) [4] (2012-01-01 to 2024-02-25), to allow for paired analyses with the EMR cohort. Body mass index (BMI) was categorized as 'underweight' (under -2 SD from the median), 'healthy weight' (-2 to +1 SD), 'overweight' (1 to 2 SD), 'obese' (2 to 3 SD), and 'severely obese' (over 3SD) using 2006 WHO BMI z-score by age/sex reference charts. Data were explored using R; nomograms were plotted, and trends were characterized using linear regression models.

Results

Data from 17,926 cases from the EMR and 16,179 cases from P-NSQIP were available for analysis. Heights were missing in 29.5% and 44.1%, respectively, preventing BMI calculation; height missingness was higher in inpatients (OR 1.82), males (OR 1.11), and some surgical specialties (including Orthopedic OR 1.94, Urology OR 1.52, or Neurosurgery OR 1.39).

Our EMR data included children classified as underweight (6.3%), healthy weight (66.1%), overweight (16.0%), obese (7.8%), and severely obese (3.8%) (Figure 1). Despite biased sampling for the P-NSQIP cohort (younger children, surgical specialty selection, more emergencies and inpatients), prevalences were similar with 6.3%, 66.0%, 17.1%, 7.6%, and 2.9%, respectively. An increase in severe obesity of 0.21% (95% CI 0.08 to 0.34, p=0.003)

per year (or 2.1% per decade) was observed (Figure 1). Exploratory analyses of undesired postsurgical outcomes for obese children are ongoing.

Discussion

We observed a current obesity prevalence (combining obese and severely obese) of 11.6%, which aligned with global trends and a worrisome increase in severe obesity rates over 12 years. Unexpectedly high missingness of height data in our EMR may prevent leveraging such local data more comprehensively. This should be mitigated through policy changes and education.

Conclusions

Once postsurgical outcome interpretation is complete, information gathered from this study can be used to plan perioperative obesity services at our hospital.

References [1] Lancet. 2024;403:1027–50; [2] Curr Pediatr Rev. 2024;20:2–26; [3] Res policy Pract. 2016;36:194–8. [4] J Pediatr Surg. 2011;46:115–21.

Regional Oxygenation and Cerebral Autoregulation with Acute Lung Injury in Neonatal Piglets

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Introduction: In neonates with acute lung injury (ALI), targeting lower oxygenation saturations (SaO2 90-95%) is suggested to limit oxygen toxicity, while maintaining vital organ function. Although thresholds for cerebral autoregulation are studied for the management of premature infants, the impact of hypoxia on hemodynamics, tissue oxygen consumption and extraction is not well understood in term infants with ALI. We examined hemodynamics using targeted neonatal echocardiography (TNE), multisite tissue oxygenation using near-infrared spectroscopy (NIRS), fractional oxygen extraction (FOE) and cerebral autoregulation from NIRS and blood gases in a neonatal porcine oleic acid injury model of moderate ALI. We hypothesized that at a threshold SaO2 in ALI animals, cerebral oxygen extraction would increase to a greater degree than kidney or gut indicative of the brain's adaptive effort to increase cerebral oxygen extraction at the expense of splanchnic end organs.

Method: After obtaining local Ethics Committee approval, fifteen anesthetized, ventilated 5-day-old neonatal piglets were divided into moderate lung injury by treatment with oleic acid or control (sham injection). Lung injury was quantified at baseline and after establishment of ALI by blood gases, ventilation parameters, lung mechanics, calculated oxygenation deficit and lung injury score by ultrasound. Hemodynamics and cardiac indices were determined by TNE. PaCO2 was maintained constant. Cerebral, renal and gut oxygenation were determined by NIRS during stepwise decreases in inspired oxygen from 50% to 21%; changes in FOE (ΔFOE) were calculated. The proportion of cerebral autoregulation impairment attributable to blood pressure and to hypoxemia was determined from autoregulation nomograms.

Results: ALI manifested as hypoxemia with increasing intrapulmonary shunt, decreased lung compliance and increased resistance, and a marked increase in lung ultrasound score. Brain (rsO2), gut and renal NIRS correlated with concurrent SVC (brain) or IVC (gut, renal) PvO2 and SvO2 . With each step decrease in FiO2, cerebral oxygenation (rsO2) decreased to a significantly greater degree and cerebral ΔFOE was greater in ALI animals compared to control (Figure 1). With SaO2 ≥ 90%, 11/16 (70%) of rsO2 measurements decreased ≥ 20% below baseline in ALI animals compared to 1/20 (5%) control (X^2 12.3, p< 0.001) . Cerebral autoregulation was impaired after ALI as a function of blood pressure at all FiO2 steps, but predominantly by hypoxemia at FiO2 < 40%.

Conclusion: In this ALI model, we could not define an SaO2 threshold below which cerebral oxygen extraction increases or above which baseline cerebral oxygenation is assured. Rather, cerebral oxygen extraction was enhanced from the onset of injury, reflecting compensation for exhausted cerebral autoregulation. The lower saturation ranges recommended for premature neonatal care may not be applicable to term infants with ALI. Continuous multi-site NIRS monitoring of regional oxygenation may help titrate FiO2 safely in these patients.

Systemic Analysis of Latent Factors Affecting Time to Definitive Management in Severe Paediatric Neurotrauma.

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Introduction: Traumatic brain injury (TBI) is a major cause of mortality and morbidity in children, necessitating timely neurosurgical interventions and neuroprotective care. Improving emergency department (ED) efficiency and readiness for imaging and surgery is critical. This study aimed to assess factors influencing care delivery for pediatric patients with severe isolated TBI through a multi-source needs assessment.

Methods: This multi-source needs assessment was conducted at a quaternary pediatric trauma center in Toronto, Canada. Baseline data from severe isolated TBI cases (2021-2022) were analyzed through retrospective chart reviews. Data collected included ED LOS, time to intubation, CT imaging, and OR. Non-value-added time was identified through prospective trauma video recording (TVR) reviews. Front-line providers participated via anonymous electronic surveys, and key stakeholders interviewed in semi-structured interviews and expert focus groups. Quantitative data were analyzed using descriptive statistics. Qualitative data underwent thematic analysis. Quality improvement tools such as process maps, pareto charts, and driver diagrams depicted the current state and potential intervention areas.

Results: Thirteen patient charts, 5 TVRs, 33 survey responses, and 14 structured interviews were reviewed. Baseline analysis showed an average ED LOS of 34minutes, intubation time of 11minutes, time to imaging of 44minutes, and time to OR of 71minutes. TVR analysis revealed gaps in neuroprotective care. Qualitative data analysis identified five main improvement themes:medical management, communication, pre-departure processes, DI, and OR readiness. SMART goals were set based on baseline data, evidence base, institutional limitations, Trauma Quality Improvement Program, and American College of Surgeons benchmarks, targeting ED LOS <20minutes, intubation time <10minutes, CT time <30minutes, OR time <60minutes, and implementing a neuroprotection bundle.

Two pathways were developed; Code Neurotrauma incorporating a neuroprotection bundle and Code Neurotrauma Direct to OR for select patients to bypass ED. Impact will be measuring using time-based outcome metrics, compliance with neuroprotective care, appropriateness of code activations as well as balancing factors.

Discussion: This study developed a standardized care pathway incorporating identified

improvement areas. Implementation of the Code Neurotrauma pathways are anticipated to achieve target outcomes in 80% of TBI cases. The highlights the importance of systematic QI approaches in pediatric TBI management.