HOT TOPIC

SHOULD HEIGHT BE MEASURED ROUTINELY AS PART OF THE PAEDIATRIC PREASSESSMENT?

SUMMARY OF KEY POINTS:

- Only 52% of hospitals in the UK routinely measure height in paediatric patients, and 24% calculate Body Mass Index (BMI) (1).
- Children living with obesity are overrepresented in the paediatric surgical population (1).
- BMI is essential in screening for this patient subgroup, with the potential need for further preoperative investigations and preparation for additional challenges presented to the anaesthetist, due to increased perioperative risks.
- Safe drug prescription relies on different size descriptors, some of which require height to be measured (2).
- Proactive identification of overweight/obese children enables healthcare professionals to offer lifestyle and diet advice, making full use of the 'teachable moment' in the perioperative period.

REVIEW OF EVIDENCE

Background

Obesity is currently one of the greatest public health challenges, described as a global epidemic affecting both children and adults. In England, 2021/22 data from the National Child Measurement Programme demonstrated 10% of reception age children (age 4-5 years) were living with obesity, roughly doubling to 23% in children aged 10-11 (3). Moreover, the recent multi-centre UK-wide prospective PEACHY study showed that overweight/obese children are overrepresented in the surgical paediatric population, presenting at 24% (1). This represents a vulnerable group of patients susceptible to higher perioperative risks, for whom additional considerations are required.

APAGBI guidelines recommend all children should have their weight and height recorded at the preassessment clinic and/or on the day of procedure (4). Additionally, BMI centile should be calculated. Despite this, 48% of UK hospitals do not routinely measure height and 76% do not calculate BMI in paediatric patients presenting for surgery (1). With increasing pressure on NHS services, a potential barrier may be the additional staff time, training and equipment required. Hence, this article aims to review the evidence behind the routine measurement of height in elective paediatric patients.

Identification of overweight children and children living with obesity

BMI is derived from dividing weight (kg) by height squared (m^2). Subsequently, BMI centile as determined by gender-specific charts and hence weight category are determined, with a BMI centile of ≥91 classified as 'overweight', ≥98 as 'obese', and ≥99.6 as 'severely obese' (2). Hence, BMI is used to screen for the presence of obesity (5), enabling tailoring of patients' perioperative care. Clinicians are poor at the visual identification of obesity, and unconsciously regarding it as 'the new normal' may lead to cases being missed (1,6). BMI has high specificity (0.93, CI 0.88-0.96) but low sensitivity (0.73, CI 0.67-0.79) at detecting obesity in children (7). Other methods for assessing body adiposity composition such as measurement of skinfold thickness and cross-sectional imaging may proffer greater accuracy, although entail additional staff training, costs and radiation risk (8).

It is worth noting that solely measuring BMI is inadequate; it is vital that parameters are then communicated to the patient and family in a meaningful way. PEACHY demonstrated that BMI was largely not expressed as an age or sex-specific value (1). This is crucial, as BMI thresholds for various weight centiles change with age (for instance a BMI of 20 at 8 years is equivalent to BMI 30 at 18 years of age), and vary according to gender (9). Further training of staff may be indicated, as PEACHY also revealed that

38.6% of patients with severe obesity were incorrectly classified as ASA 1 (1), in contrast to the ASA-PS guidelines which indicate children who are overweight and obese should be classified as ASA 2 and 3 respectively (10).

Why is it important to screen for obesity?

Obesity and its attendant perioperative risks

Identification of overweight children and those living with obesity enables risk stratification and planning of subsequent perioperative care. Practical tips on safe intraoperative anaesthesia of these children are beyond the scope of this article, and recent guidelines from The Society for Obesity and Bariatric Anaesthesia (SOBA) provide a good framework (2). Preassessment should ideally be scheduled 2 weeks in advance of the planned procedure, allowing adequate time for further investigation and addressing of relevant issues (4). In children undergoing adenotonsillectomy, national guidelines provide criteria for referral to high-acuity or tertiary centres based on extremes of BMI centile (<0.4th and >99.6th) and presence of high risk factors (11). Obesity is associated with multi-organ sequelae, such as: obstructive sleep apnoea (OSA); gastro-oesophageal reflux disease; type 2 diabetes mellitus; dyslipidaemia and idiopathic intracranial hypertension (9). These can pose problems occurring at any stage of the perioperative journey, some of which may be life-threatening.

Complications affecting the respiratory system should be highlighted; these include central hypoventilation syndrome, asthma and OSA, leading to subsequent perioperative adverse airway events such as bronchospasm and airway obstruction (12,13). Caution is advised regarding the administration of preoperative sedation, due to the higher risk of respiratory depression. Furthermore, mask ventilation and maintenance of airway patency are more difficult to achieve (1,13). The evidence is divided regarding obesity and the increased risk of certain perioperative respiratory complications; Nafiu et al. did not observe a higher occurrence of bronchospasm in obese children despite a higher incidence of asthma (12), however it is unclear if surgery and airway type were controlled for.

Postoperative discharge destination

Day case surgery is preferable in paediatrics, however obesity may confound this aspiration (9). Children with obesity face a prolonged recovery (14), higher rates of same-day admission in children with obesity classes 2 and 3 (15) and a longer PACU stay (1). The presence of obesity does not preclude day case surgery, although prolonged postoperative monitoring may be required. Hence, careful list management with high-risk patients scheduled as early as possible is recommended (2). Shine et al. propose that routine PICU admission is not indicated for all morbidly obese children undergoing adenotonsillectomy, on the recommendation that a suitable high level of nursing care is available in an alternative setting (16). Cappitelli et al. found that obese and non-obese children undergoing reduction mammoplasty did not have a significantly different prevalence of medical comorbidities or major anaesthetic sequelae (17). This may be due to the small sample size, biases at selection level, or surgery involving relatively superficial tissues. Hence, departmental protocols should be tailored to surgery type, local practice, and patient population.

Education and secondary prevention

Obese children are five times more likely to become obese adults (18), and childhood obesity is considered largely preventable (1). Within the preassessment pathway, consideration should be given to providing advice and directing families to additional support for conditions such as childhood obesity (4). However, 66% of UK hospitals do not offer dietary or lifestyle advice to children living with obesity and their family, which reflect missed opportunities to ‘exert a positive influence on the future trajectory of these children’s lives’ (1).

Other height-derived parameters and their relevance

In addition to deriving patients' BMI with their height, other body size descriptors may also be calculated, such as Ideal Body Weight (IBW) and Adjusted Body Weight (AdjBW) (2,5).

- IBW is defined as the healthiest weight for a child for their height, gender and age. It represents the weight associated with the longest life expectancy and may be derived from multiple methods, including the reverse BMI equation: IBW = BMI_{50} × height^2 where BMI_{50} represents the 50th centile of the BMI chart. Using IBW may run the risk of underdosing medication (19).
- In contrast, AdjBW uses the child's IBW and adds a specified cofactor which is a fraction of the excess weight gain between IBW and TBW: AdjBW = IBW + 0.35 (TBW − IBW). (0.35 is recommended as a pragmatic solution to calculating AdjBW in children living with obesity (20))

Using these descriptors instead of Total Body Weight (TBW) is indicated in certain scenarios, which will be explored in the following sections.

Drug administration and pharmacovigilance

Weight-based dosing is implemented when prescribing for paediatric patients, with TBW traditionally being referenced. However, as the increased weight of children living with obesity is not comprised of similar proportions of fat and lean tissue, there is a risk of overdosing certain drugs should TBW be used (5). Overweight children and those living with obesity have been repeatedly shown to face a higher risk of receiving drugs at doses outside recommended ranges (21,22). Prescriptions of supra-recommended doses of opioids have been observed (21), additionally in the context of ambulatory surgery, a worrying practice considering patients' increased risk of respiratory depression (23).

Concurrently, clinicians with awareness of such risks may intentionally undertake arbitrary dose reduction in an attempt to mitigate toxic effects, especially in time-pressured clinical situations (5). However, failure to achieve adequate drug effect site concentration may also entail adverse effects; Neostigmine was noted to be prescribed at lower-than-recommended doses (23), and inadequate reversal of neuromuscular blockade may increase the risk of postoperative pulmonary complications. A lack of clear guidance may underpin this: in one study, 65% of drugs demonstrated altered pharmacokinetics (PK) with obesity, yet none had dosing guidance which factored altered body composition (24); prescribers may also choose to estimate doses rather than perform complex calculations (23). Notably, a significant flaw of dose-evaluation studies in this patient subgroup is the lack of clinical outcome reporting, hence the true impact of incorrect prescribing remains unknown. Bearing all this in mind, how then should drugs be dosed in children living with obesity?

Due to the complex interplay of variables, there is unfortunately no 'one-size-fits-all' approach. Obesity leads to physiological changes which alter drug PK, hence influencing which size descriptor to reference. The increase in fat mass is thought to outweigh that of lean mass, approximately 75% of excess weight is attributed to the former and the remaining 25% to the latter; this varies between individuals and ethnic groups (25). Loading doses are based on volume of distribution, and for relatively hydrophilic drugs which distribute mainly into lean body tissue, loading dose is based on IBW (20). In contrast, AdjBW may be more appropriate in relatively lipophilic drugs (20). Maintenance doses are based on drug clearance, although this does not predictably increase proportionally with body weight (20) and enzyme activity may be upregulated in the presence of hepatic steatosis (19). Furthermore, it is challenging to reliably predict the magnitude of dose change required, with patient and drug-related factors also requiring consideration. These are not limited to: the nature of illness and relative risks of over versus undertreating; extent of obesity; drug therapeutic range and side effect profile; and existing evidence from PK studies on children living with obesity (20). Current guidelines provide a general framework to base clinical practice on (2,20).

There is a paucity of high-quality drug-specific PK studies tailored to overweight/obese children, and dosing guidelines are typically derived from available data from obese adults (19,20). Barriers include: small sample sizes; the opportunistic nature of such studies; and confounding effects of drug-drug interactions not being accounted for (26). The recently launched PaedsPro app (27) supports best evidence dosing calculations in obese children, providing adjusted, ideal or lean body weight dose recommendations in children with BMI >97th centile. Overall, it is recommended that pharmacological treatment should not rely solely on calculated dose, but also involve regular reviews to ensure patients are receiving the correct dose from an efficacy and safety point-of-view (20).

Conclusion

Height is essential for calculating patients' BMI and hence BMI centile, allowing for a cost-effective method of screening for obesity. Screening also enables meaningful and educational conversations between clinical staff, patients and their families which may have a significant role as a public health intervention. Height measurement also forms the basis of deriving other body size descriptors to allow for safe prescribing, exemplified in recent guidelines. There may also be a role for electronic health records and automated calculation of these values, serving to streamline the process, improve clinician engagement/knowledge and ultimately patient safety.

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