Introduction

Overnight fasting is considered a vital step for the safe induction of anesthesia in children before surgical procedures to minimize the threat of gastric aspiration throughout surgery as a result of decreasing the acidity and volume of stomach contents [1, 2]. In addition, the preoperative fasting period may lead to an alteration in body metabolism as the child approximately fast about 10–15 hours before surgery [2].

In particular, the quantity, kind of fluid, and food that children require preoperatively differ according to the developmental age [1]. In other meaning for preoperative fasting, it’s planned to minimize the residual gastric volume and acidity before any procedures or surgery that requires type anesthesia or sedation [2]. Also, helps to avoid regurgitation and aspiration of stomach contents, especially in children with a history of gastroesophageal reflux, hiatal hernia, morbid obesity, and difficult airway [3].

Fasting for a long duration may expose the children to stressful experiences due to hunger, thirst, irritability, dehydration, and hypoglycemia [4]. The benefits of short-duration fasting before operation minimize the need for fluid therapy replacement, minimize postoperative dehydration, and lower the risk for aspiration and other undesired symptoms [5]. Due to the presence of conflicts between preoperative fasting duration and lack of universal applied guidelines to be followed.

The overall aims of this review are 1) to define preoperative fasting and pulmonary aspiration about gastric emptying in children prepared for surgery; 2) to discuss the conflict of preoperative fasting duration and volume, and 3) to explain the benefits and hazards of fasting which may contribute to physical distress or well-being according to practices.

Materials and methods

Search strategy

A search of CINAHL, EBSCO, PubMed, and MEDLINE databases was conducted using the following keywords: preoperative fasting, pediatric preoperative fasting, preoperative fasting duration, preoperative intake; review
ting, preoperative fasting duration, and preoperative intake, 150 articles were located, and 17 articles were included in this review.

Results
Preoperative fasting is defined as a phase of time before a procedure or surgery when patients are not permitted to have any solids or liquids oral intake [6]. Preoperative fasting is known as a routine procedure in a surgical unit that decreases the threat of nausea, and vomiting and avoids gastric contents aspiration which leads to pulmonary aspiration [6]. Preoperative fasting is one of the safe measurements in children to prevent harmful complications during operation specifically pulmonary aspiration, as known this is practically applied as nil per os (NPO) from midnight till the time of operation [7].

As described, preoperative fasting is a limitation of oral intake either solid or fluid before induction of anesthesia or sedation applied for a safety measurement [4]. The initiation of anesthesia poses the normal physiological protective barrier in the respiratory tract to depression (gag, cough, and swallow reflexes) which lead to exposing the child who underwent the surgery to the dangers of regurgitation and pulmonary aspiration [4]. Children are usually starving for fluid and food before their surgical procedure to reduce the hazard of aspiration [1]. Induction of anesthesia alleviates the action of laryngeal reflexes which resulted in exposing children to the hazard of pulmonary aspiration [8] which gives the rationale to a routine of NPO at midnight to make certain that the stomach is empty [8]. Heyman [9] clarified the idea of gastric emptying as described in this study, after oral intake of a regular meal, the food moves toward the stomach, the smooth muscle will be relaxed, and automatically increase in volume lead to a minimal rising the tonic intraluminal pressure in the stomach fundus which is playing a vital role for the emptying of liquid meals, while antral peristalsis is needed for the emptying of liquid and solid meals (which acts as stimulants for antral contractions). On the other hand, solids are shaped in the stomach during digestion, which may clarify the varying interval of emptying with different types of milk feedings, as well as the presence of different and several gastrointestinal enzymes that may play roles in delaying gastric emptying such as gastrin, secretin, cholecystokinin and gastric inhibitory peptide [9]. Even though liquids empty more quickly than digestible or indigestible solids meals, additional factors concerning the meal are important, emptying is delayed with larger meals [9]. Also, rising osmolality delays emptying in an older child [8—10], but within restrictions does not affect premature infants and normal newborns [9]. On the other hand, the gastric empty of cow’s milk slower interval than human milk [9].

The interval and length of fasting are become an important issue due to the long duration of starvation for children preoperative did not lead to any advantages in contrast it could be a source of stress for the child and his family [10]. Yasmin and colleagues [3] believed that increasing fasting time leads to decreasing injury of aspiration, but at the same time, there’s a tendency for the raising of gastric volume due to prolonged periods of fasting which stimulates the stomach to secrete gastric juice, so the volume increased. In addition, may expose the child to thirst, dehydration, stress, and hypoglycemia. Klemetti and Suominen [5] considered preoperative fasting a stressful process for the children because they don’t understand why they can’t eat and how in addition parents worry about the nutritional status of their children pre and post-surgery.

Long-duration fasting before surgery from 8—12 hours seems to be a complicated process due to an accompaniment with undesired problems post-surgery like thirst, hunger, irritability, and dehydration and may cause hyperolemia and fluid disturbances, especially in children, but as they rationalized, it is to reduce the volume of stomach contents and its acidity, as a result, the threat of aspiration will be diminished [5]. Castillo-Zamora, Castillo-Peralta, Nava-Ocampo [11] found that as a result for prolonged fasting contributed to increase residual gastric volumes (RGV), in contrast when they interrupted the long fasting for a patient by serving oral iso-osmolar solution in the early morning of the day of surgery the RGV decrease to the half and pH increased. In addition, the study results indicated that the effectiveness of early morning serving of oral clear liquids for 2—3 hours reduces the risk of prolonged fasting hypoglycemia which saw as a case in children who underwent 12 hours of fasting before surgery [11].

As studies showed, prolonged fasting before surgery increases postoperative nausea and vomiting which may expose the child and family to the problem of a long staying in a hospital [11]. Furthermore, as evidenced by several studies prolonged fasting exposes children to thirst, hunger, and anxiety [12]. The researchers found that the 6 hours of fasting before surgery has no advantages to children and can’t decrease the risk of pulmonary aspiration, on the other hand, oral intake of clear fluids 2 hours before surgery decreases the risk of dehydration [12].

The researchers concluded that even though the long duration of preoperative fasting is a period ordered before surgery as preoperative preparation to decrease the risk of gastric aspiration, at the same time it exposes the child to high risks and hazards due to a long duration of starvation [11]. The researchers showed another point to be a concern that the children consider a vulnerable group for prolonging fasting duration before surgery, that’s related to high metabolic rate. As a result, children less than 1 year are vulnerable to the risk of hypoglycemia due to fasting, so in this study, they encourage short time fasting before surgery [10].

Preoperative assessment in children should include a physical assessment starting with history which gives information about problems that enhance the risk of pulmonary aspiration like gastroesophageal reflux, diabetes mellitus, gastrointestinal disorders, and dysphagia. As well as they conducted that there are no effects of prolonged fasting before surgery on reducing gastric volume or increase of pH [10].

For safe outcomes during surgery in preventing pulmonary aspiration, comprehensive preoperative assessment should be superior before prolonged fasting, because prolonged fasting has no benefits in avoiding or
decreasing this hazard [13]. So, the risk of pulmonary aspiration concerning prolonged fasting to have an empty stomach it’s not real and incorrect, and other predisposing factors should be assessed by skillful health team preperation for risky children who may tend to increase gastric pressure, a tendency to regurgitate, and laryngeal incompetence, which increase the incidence of pulmonary aspiration [13]. Although prolonged fasting until the time of surgery doesn’t reduce the hazards of unexpected pulmonary aspiration and regurgitation, until now it’s still as blanket fasting policy as the researcher described [13].

Researchers reported that minimizing the duration of prolonged fasting enhances and promotes well-being and oral intake, and decreases the discomfort of thirst and hunger after surgery in children [8]. Gebremedhn and Nagaratnam [14] reported and described a result of prolonged fasting in children in this quantitative cross-sectional study; it’s a harmful and stressful experience due to hunger and thirst for children. A study conducted by Schmitz and colleagues [15] showed that short-duration fasting in pediatrics contributes to promoting hydration, and a comfortable schedule to parents and reduces the anxiety level in children which makes the anesthesia process easier. Also, they recommended the practice of clear fluids 2 hours before surgery, and they evidenced that in the clinical trial on healthy volunteers children from 6—14 years fasted for 12 hours and then applied several times of Magnetic resonance imaging (MRI) scans at a different time (30, 60, 90, 120 minutes) to detect the gastric empty and residual volume after they interrupted the children fasting by oral intake of diluted raspberry solution and they found that the empty of clear fluids in stomach started after 30 minutes of half-life as GFV and after one hour of half-life for residual volume with variation according to children [16].

Mannix and Collins [7] reported that oral clear fluids up to 2 hours before surgery reduce risk in gastric fluid volume or decrease in pH if compared with traditional fasting (up to six hours), in addition to the undesired impact of traditional fasting like (thirst, hunger, discomfort, and pain) are improved in oral clear fluids 2 hours preoperative [7]. Also, the authors stated the standard for short fasting as 4 hours for children younger than one year, 6 hours for children aged 1–5 years, and 8 hours for children older than 5 years [7].

This study for preoperative fasting also mentioned another recommendation, no problem with clear fluids rich in carbohydrates up to 2 hours before anesthesia. On the other hand, oral solid meals need 3—6 hours to empty the stomach but in combination to stress the time of emptying may delay, so they advise that, no solid meal on the day of surgery [13].

Short-duration fasting improved long-duration complications, also increase comfort and positive outcomes and that was evidenced by several controlled trials in this study which recommended short-duration fasting and at the same time kept safety [4]. Also, they recommended that clear fluids 2 hours before surgery are helpful, not harmful, and decrease nausea and vomiting post-operation with no effects on gastric volume or pH and for light breakfast 4—6 hours before surgery which was evidenced by a randomized controlled trial [4].

Yurtcu and colleagues [16] conducted the study among 80 children divided into 8 groups each one has 10 children prepared for inguinocele scrotal region surgery with ages of 1—10 years, and they fed normal liquid food to the first 4 groups and a high-calorie diet to another 4 groups at different times before surgery (2—6 hours). As a result of each four groups, there is no difference in metabolic changes between children who experienced surgery after a long and short interval of fasting, so there is no necessary for long-duration fasting before surgery, and 2 hours enough to be as a protocol in the same types of surgery in this study [16]. In addition, the administration of clear lipids 2 hours before surgery did not pose to affect or enhance the risk of gastric aspiration in a healthy child inverse it decreased the irritability of the child which adds psychological support utilization [16].

Smith and colleagues [6] in the European Society of Anesthesiology recommended that preoperative fasting for clear fluids for up to 2 hours (water, pulp-free juice) and 6 hours for solid food before an elective surgery for healthy adults and children and obese or diabetic patients, and patients with gastroesophageal reflux. Infants should be nourished with breast milk for up to 4 hours and it’s a safe process and other milk for up to 6 hours [6]. Also, it’s safe to have liquids rich in carbohydrates up to 2 hours preoperative, these recommendation acts as safe and beneficial guidelines [6]. With facts and evidence from several studies, the children can have a clear fluid via oral up to 2 hours before surgery at the same time fasting doesn’t reduce gastric fluid volume [10]. Also, the length of duration must base and reflect healthy and balanced criteria for fasting depending on the face of the hazards of long starvation and aspiration [10].

Braga et al. [17] concluded that oral intake of carbohydrates before surgery in children considers a safety measure to reduce postoperative insulin resistance and decrease the risk for hypoglycemia. Castillo—Zamora et al. [11] reported that oral intake of apple juice in the early morning before surgery avoids dehydration and acts as a preferable performance and they recommended that to be assertive according to results not to continue on routine NPO from midnight for children prepared for surgery. Klemetti et al. [8] reported that minimizing the duration of prolonged fasting enhances and promotes well-being and decreases the discomfort of thirst and hunger after surgery.

As a normal physiological process, gastric empty duration of both carbohydrates needs 90 minutes after ingestion, which gives a chance for the child to intake carbohydrate-rich fluids before the surgical procedure [2], with some precautions to those risky cases in addition to gastric emptying can decrease the pulmonary aspiration. Mannix and Collins [7] stated the regimen of preoperative fasting that evidenced by several studies resulted in beneficial outcomes for children and their parents (comfort, promoting hydration, and reduction of the level of stress). In addition, they concluded that an unlimited amount of clear fluids two
hours before surgery, four hours for breast milk, six hours for non-human milk and solids, and eight hours for a meal rich in lipids before surgery [7].

Discussion

The differences and variation in milk emptying depends on its components. Breast milk and whey-based milk emptied faster than cow’s milk or casein-based milk. On another side, several studies are done before the induction of anesthesia to determine the time for gastric emptying in infants according to the type of formula and they concluded that either breast milk or other formula needs more than 2 hours to be sure that the stomach emptied. Both cows and powdered milk counted to be a solid formula concerning preoperative fasting. A large amount of milk may consider a solid due to milk curdles in the stomach but a regular amount considers a clear fluid. Breastfeeding should be stopped 4 hours before surgery and 4–6 hours in another infant formula.

Whereas numerous studies recommended that oral intake of fluids 2 hours before surgery will reduce the gastric volume by the normal physiological process. Preoperative fasting duration for children depends on the age of the children with hypoglycemia. The previous studies recommended that 2, 4, 6, 8 hours duration for children less than three years who are a risk for hypoglycemia rather than others. For children above three years, they recommended the time of fasting according to the time of operation (morning operation, afternoon operation 1:00 pm) as incoming: children prepared for morning operation, should fast from midnight with permission of clear fluids up to 2, 6, 8 hours before surgery, which includes water and fruit juice. As reported and described as a result of prolonged fasting in children in this quantitative cross-sectional study, it’s a harmful and stressful experience due to hunger and thirst for a child. For safe sedation, 2 hours for oral clear fluid, 4 hours for human milk, 6 hours for infant formula and non-human milk (it’s considered a solid meal to be emptied), and 6 hours for light food (toast and certain formula). Breastfeeding should be stopped 4 hours before surgery and 4–6 hours in another infant formula.

Conclusions

Preoperative fasting is one of the safe measurements that should be concerned for all health team members including nurses, surgeons, consultants, and a prior anesthesiologist doctor, and at the same time focusing on the comprehensive assessment before surgery which helps in expectations of hazards can be managed or may expose children to dangers of lung damage. Also, prolonged fasting as shown to be compared to a short fasting period contributes to a high risk of undesired complications without benefits in decreasing the pulmonary damage in resulted from pulmonary aspiration which recorded low incidence in normal-risk children as also in high-risk children. Short-duration fasting included oral intake of fluids rich in carbohydrates as reported and recommended by evidenced cases in studies that showed a positive outcome post-surgery for children, either physically or psychologically and sometimes economically wise. Although these findings showed a big conflict to having a policy for preoperative fasting, so new guidelines for normal-risk children should be applied and implemented as a written evidenced strategy by the presence of a cooperative multidisciplinary team, with precautions and specific instruction for children with a high risk, to improve comfort and well-being which resulted in enhanced welfare and may improve quality of life for children.

References

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Передоперационное голодование в детях

Резюме. Актуальность. Цей огляд спрямований на визначення передоперационного голодования, а саме спорожнення шлунка в дітей, яких готовлять до операції, обговорення конфлікту між тривалістю й обсягом передоперационного голодования, а також з’ясування переваг та небезпек, пов’язаних з голодуванням, що можуть призволити до фізичного дистресу або покращувати самопочуття.

Матеріали та методи. Було проведено пошук у базах даних CINAHL, EBSCO, Science Direct, Google Scholar, PubMed та MEDLINE. Знайдено 150 статей, до цього огляду увійшло 17. Результати. У результаті огляду виявлено, що передоперационне голодование є одним із безпечних заходів, який потребує залучення усіх медичних працівників з одночасною комплексною оцінкою, що допомагає передбачити ризики для дітей перед втручанням. Висновки. Основним конфліктом є необхідність політики передоперационного голодования, тому слід застосовувати та впроваджувати нові рекомендації для дітей, яким готують до хірургічного втручання.

Ключові слова: передоперационне голодование; передоперационное голодование в детях; тривалость передоперационного голодования; передоперационний прийом їжі; огляд

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