OPERATIVE SETTINGS: CUSTOM MADE - VERSUS STANDARD SURGICAL DRAPES

Boia ES[1, 2], Salvante ERG[1,2,*], Nyiredi A[1,2,*], David VL[1,2], Stanciulescu MC[1,2], Pal AC[1,2,*], Marcu S[2], Mussuto E[2], Popoiu CM[1,2]

Abstract

Surgical drapes are used as a method to keep sterility and asepsy in the operating settings of a surgical procedure. Nowadays disposable surgical drapes are included in standard size kits. The study includes 96 patients operated in the "Louis Țurcanu" Emergency Clinical Hospital for Children Timișoara and it was conducted in between September 2017 - March 2018. The research aims to explore other feasible option to the standard surgical drapes kits. A custom made surgical drape model was conducted by using age related classes anthropometric measures.

Key words: Surgical drapes, children, operating room

Introduction

The operating room is one of the most demanding healthcare sites. It implies both large maintenance costs and a growing need for adaptability [1] by adjusting to the technological progress. Thus it is prone to large quantities of waste. One of the most disputed surgical settings regards the surgical drapes used.

There are two types of surgical drapes: reusable or disposable. The reusable drapes are made of a woven material and are laundered and sterilized for the next surgical procedure. On the other hand, disposable drapes are usually made of non-woven material and are incinerated after each operation [2].

There is considerable variation in design and performance characteristics within each of these two broad categories, which reflects the necessary trade-offs in economy, comfort and degree of protection required for particular surgical procedures [3].

It remains unclear which drape type is superior at preventing infections and, internationally, this has resulted in a lack of consensus on which drapes to use, despite attempts to develop guidelines [2].

However, single-use surgical drapes tend to gain popularity over the reusable, woven material drapes

Purpose

The aim of the present paper is to emphasize the importance of custom made surgical drapes divided by age related classes for the Pediatric Surgical Ward. This measure is cost-effective by reducing surgical drapes acquisition costs, reducing wastes from a pediatric surgical department and being easier to use when adapted to the patient dimensions and needs in a Pediatric operating room..

Materials and Methods

The data was collected on surgical cases performed in the Clinic of Paediatric Surgery and Orthopaedics of the "Louis Țurcanu" Emergency Clinical Hospital for Children Timișoara. The study was conducted between 1st September 2017 and 31 March 2018 and included 96 patients operated in the Clinic. Data was collected prospectively, including data regarding the patients and data related to the operative settings used during the surgical procedures.

Inclusion criteria were selected in order to choose a sample of relatively homogeneous patient population. Patients over 18 years old, patients for whom more than one kit of surgical drapes were used, patients standing procedures involving special surgical drapes were excluded.

Patients' data included age of each child and anthropometric measurements such as weight (W), height (H), and thoracic circumference (TC). Imagistic measurements were also used (antero-posterior thoracic diameter).

The thoracic circumference of each patient was collected by measuring the chest perimeter at the level of the xiphoid notch [4]. The antero-posterior diameter was calculated by measuring the depth of the chest on chest X-rays from the level of the carina (6th intercostal space) on a maximal inspiratory image [5].

Standard surgical drapes' settings were measured and analyzed. The standard drapes kits used in the clinics comprise two lateral fields measuring 75x90 cm each (LF), a drape used to cover the Mayo table measuring 78x145 (Mayo), a drape used for the dressing of the surgical instrument table measuring 150x190 cm (Instr.Table), a proximal drape measuring 140x240 cm (ProxDrape) and a distal drape measuring 180x182 cm (DistDrape). The total amount of fabric used to isolate a patient (StdPatientDrape) was calculate by formula in Fig. 1.

[1]"Victor Babeș" University of Medicine and Pharmacy, Timișoara
[2] "Louis Țurcanu" Children's Emergency Hospital, Timișoara
*PhD Student
E-mail: boiaeugen@yahoo.com, icamcsalvante@gmail.com,, alexnyiredi@gmail.com, david.vlad@umft.ro, stanciulescucorina@yahoo.com, alexandar.pal@yahoo.com, stefy_aslan@yahoo.com, elisamussuto@gmail.com, mcpopoiu@yahoo.com

$$StdPatM < ientDrape = LF * 2 + ProxDrape + DistDrape.$$

Fig. 1. Formula to calculate the amount of fabric

$$BSA = \sqrt{height\ x\ weight\ x\ 0.016667}\ [6]$$

Fig.2. Formula tocalculatethe area occupied by a patient

$$1)\ \frac{BSA}{2} * \frac{1}{TableSA};$$

$$2)\ \frac{BSA}{2} * 1/StdPatientDrape$$

Fig. 3. Impact of the body surface of the patient over the total area of the operating room table (1) and total surface of the surgical drapes (2)

$$PatientNeed = (\pi APTD^2 + 2\pi APTD * H)1/2\ .$$

Fig.4. strict need of fabric calculation

$$Transition = (2 * L * 50cm) + (2 * Wi * 50cm).$$

Fig. 5. Formula for need for fabric taking into consideration the pseudo-semi-cylindrical shape of a laying patient

Custom drapes = PatientNeed+Transition

Fig. 6. Formula for modified surgicaldrapes

The surgical table used for the procedures measured 174 cm in length (L) and 60 cm in width (Wi). The surface area (Table SA) was calculated accordingly.

In order to estimate the area in square meters occupied by a patient, for each child of the study was calculated his/her Body Surface Area by using the Mosteller formula in Fig. 2.

Two indices of impact of the body surface of the patient over the total area of the operating room table, and the total surface of the surgical drapes were calculated using these two formula in Fig. 3.

We imagined further a mathematical model calculating the need for fabric taking into consideration the pseudo-semi-cylindrical shape of a laying patient, two anthropometric measurement (H, APTD), and a transition sterility zone. In order to calculate the strict need of fabric to cover the patient (PatientNeed) we used the following formula in fig. 4.

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Finally, the proposed a modification to the standard side of the drapes calculated by the formulain fig. 6

Results

The sample included 96 children aging from 0 months until 18 years. The patients have been grouped in six age related classes: Newborns “0”, one to six months “1-6 mo”, seven months to one year “7mo-1yr”, one year to six years “1-6 yrs”, six years to fourteen years “6-14 yrs”, fourteen years to eighteen years “14-18 yrs”.

Average height, average weight, and average anteroposterior thoracic diameters (APTD) have been calculated and the results are shown in the graph below (Fig. 7).

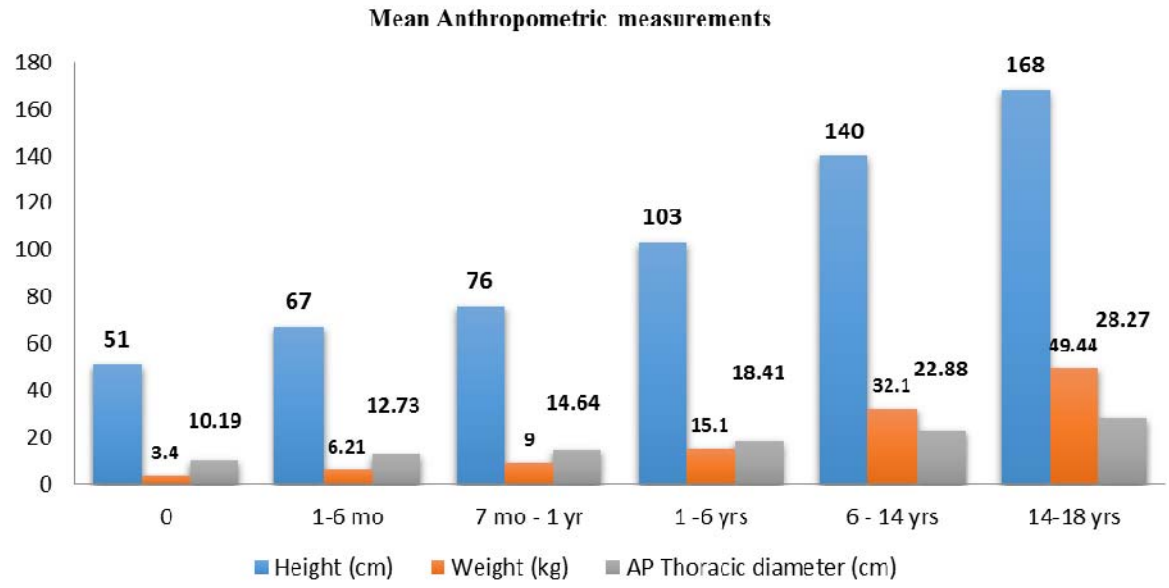

Fig. 7. Mean Anthropometric measurements

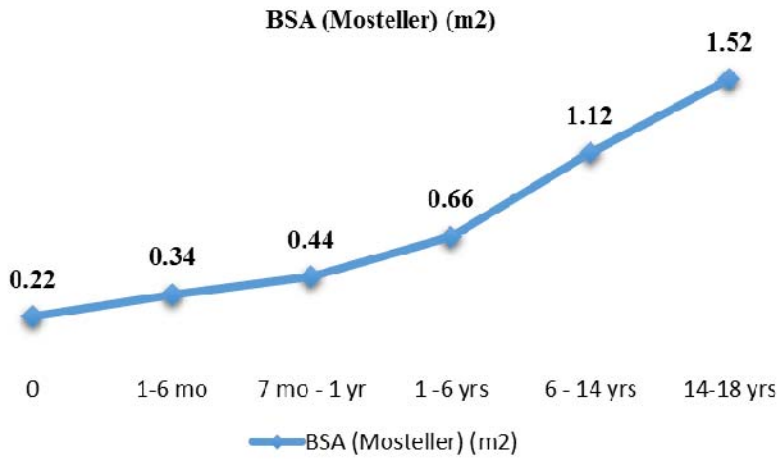

Fig. 8. BSA (Mosteller) (m^2)

Drapes / class	Newborns	1-6 mo	7mo-1yr	1-6 yrs	6-14 yrs	14-18 yrs
Lateral (cm)	48/40	49/41	51/42	53/44	57/47	61/51
Proximal (cm)	97/92	99/93	101/95	106/100	113/107	121/115
Distal (cm)	129/97	131/99	134/100	140/105	151/113	162/122

Table 1. Proposed size forthe surgical kits

The index describing the impact of the body surface of the patient over the total area of the drapes was calculated for each age group. Values of 0.026, 0.041, 0.052, 0.071, 0.134, 0.182 were calculated for each of the six age related group respectively.

The proportion of the surface of the table occupied by the children during procedures was calculated for each age category resulted in values of 10.55%, 16.34%, 20.96%, 31.60%, 53.72%, 73.03%. for each group.

The result of the transition zone is 2.340 sqm and it is the same for each class of age. Considering the relative small surface percentage of the used surgical drapes within the draping of a patient, we proposed creating custom made surgical drapes divided by age related classes for the Pediatric wards. As a consequence six surgical drapes dimension according to the age related class were calculated: 2.52sqm, 2.63sqm, 2.72sqm, 2.99 sqm, 3.43sqm, 3.96 sqm.

Thus, respecting the classical fashion of four drapes operating field we have designed 6 surgical kits made out of four drapes based on the standard proportions as shown in table 1.

Discussions

Standard kits of surgical drapes are costly and not specifically designed for paediatric patients' needs.

The variability of the dimensions in the paediatric patient makes the axiom "one size fits it all" not a feasible method of draping the patient in the paediatric surgical ward. This statement is supported by the fact that according to our calculations (BSA/2*1/StdPatientDrape) the age group with the largest dimension the proportion of the surface of the drape occupied by the patient is less than 19%.

It is estimated that the operating theatre accounts for a large proportion of hospital waste therefore operating room waste reduction should be considered as a method of decreasing costs in the paediatric surgical ward [7].

The proposed model allows the surgical unit to arise significant financial savings, environmental benefits by cutting down the material used for draping the patient. A reduction of the fabric needed coincides as well with a lower probability of surgical drapes having contact with free oxygen in the operating room therefore reducing the risk of fire in the operating theatre setting [8]. Furthermore the model, including the transition sterility zone could provide an effective method of combined patient need and reduced risk of surgical site infection. Our proposal is to implement a feasibility study to test the applicability of the model in the paediatric surgical ward.

Conclusions

The choice of an efficient surgical draping system can be a dilemma with a relevant impact on a Paediatric Surgical Ward. The amount of fabric needed must answer the necessities of asepsis, sterility, feasibility and cost-effectiveness required for the well functioning of a surgical unit.

Nonetheless the theoretical nature and further applicability studies needed to implement the imagined draping system, the custom made surgical drape model can be considered an answer to the request of flexibility, economy, strictness, security and environmental compatibility required in a modern surgical ward.

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Correspondence to:

Salvante ERG
"Victor Babes" Universityof Medicine and Pharmacy
2 EftimieMurgu, Timisoara, Romania
Email: icamcsalvante@gmail.com