ASSESSMENT AND CONTROL OF INSTRUMENTS UTILIZED IN OPERATING ROOM DURING THORACIC SURGERIES

Avaliação e controle de instrumentais utilizados em sala operatória durante cirurgias torácicas

Evaluación y control de instrumentales utilizados en quirófano durante cirugías torácicas

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ABSTRACT: Objective: To assess the number of unused surgical instruments during thoracic surgeries performed at a university hospital. **Methods:** An exploratory, descriptive, cross-sectional study with a quantitative approach, conducted by gathering data on the use or lack of use of surgical instruments present in the surgical box. **Results:** A total of thirty thoracic surgeries were observed, with a mean of 84.53% of instruments utilized for surgery and a mean of 15.48% of instruments left unused. **Conclusion:** A reconfiguration of the surgical boxes for this specialty is needed in order to optimize the utilization and the process of these instruments.

Keywords: Surgical instruments. Cost control. Surgical procedures. Operative procedures. Thoracic surgery. Perioperative nursing.

RESUMO: Objetivo: Avaliar o número de instrumentais cirúrgicos não utilizados durante as cirurgias torácicas realizadas em um hospital universitário. **Métodos:** Trata-se de um estudo exploratório, descritivo, transversal com abordagem quantitativa, realizado a partir do levantamento de dados sobre a utilização ou não de instrumentais cirúrgicos presentes nas caixas cirúrgicas. **Resultados:** Foram observadas 30 cirurgias torácicas, sendo a média de instrumentais utilizados por cirurgia de 84,53% e a média de instrumentais não utilizados de 15,48%. **Conclusão:** São necessárias reformulações na composição das caixas cirúrgicas dessa especialidade a fim de otimizar a utilização e o processamento dos instrumentais.

Palavras-chave: Instrumentos cirúrgicos. Controle de custos. Procedimentos cirúrgicos operatórios. Cirurgia torácica. Enfermagem perioperatória.

RESUMEN: Objetivo: Evaluar el número de instrumentales quirúrgicos no utilizados durante las cirugías torácicas realizadas en un hospital universitario. **Métodos:** Se trata de un estudio exploratorio, descriptivo, transversal con abordaje cuantitativo, realizado a partir del levantamiento de datos sobre a utilización o no de instrumentales quirúrgicos presentes en las cajas quirúrgicas. **Resultados:** Fueron observadas 30 cirugías torácicas, siendo el promedio de instrumentales utilizados por cirugía del 84,53% y el promedio de instrumentales no utilizados del 15,48%. **Conclusión:** Son necesarias reformulaciones en la composición de las cajas quirúrgicas de esa especialidad a fin de optimizar la utilización y el procesamiento de los instrumentales.

Palabras clave: Instrumentos quirúrgicos. Control de costos. Procedimientos quirúrgicos operativos. Cirugía torácica. Enfermería perioperatoria.

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INTRODUCTION

The Surgical Center (SC) is one of the hospital units where high, medium and low complexity surgeries are performed and, therefore, it requires well-trained and highly-qualified staff. It is recommended that the SC be connected to the Intensive Therapy Unit, the Post-Anesthesia Care Unit and the Emergency Care Unit in order to facilitate emergency care. It is also recommended that it be near the Sterile Supply Department (SSD), in order to facilitate the flow of sterilized materials.

An SSD is defined as an area for receiving supplies, waste management, and the preparation, sterilization, storage and distribution of sterile supplies to other hospital units. Access should be restricted to working personnel and should have temperature and humidity control to keep the sterility of processed materials, avoiding bacterial growth and damage to sterile material[1,2].

As soon as it is utilized in surgery, the material is considered contaminated and is sent to the SSD, where it will undergo the process that will make it sterile again. It is worth remembering that, following the Board of Directors Collegiate Resolution (RDC) nº 30, from February 15, 2006, from the Brazilian Health Regulatory Agency (ANVISA), the resterilization of supplies is prohibited; therefore, even the materials that were merely opened yet left unused should be reprocessed, that is, go through the entire process again, from the initial cleaning to storage[3,4].

There is a vast collection of surgical instruments that have been developed to meet the needs of new surgical techniques, with the purpose of aiding, facilitating and promoting precision for surgeons. These instruments are distributed in groups — special, basic or common — according to their use and purposes during each stage of the surgery. The special instruments are utilized only during select stages of certain surgeries; in other words, they are specific instruments. The common instruments are the basic instruments present in every surgery box, and can be used in any type of intervention with the following purposes: incision, such as the scalpel blade and scissors; hemostasis, such as the Kelly forceps; grasping, such as the Allis forceps and field or Backhaus forceps; retaining, such as retractors; and suture or ligation, such as needle holders[3,5-7].

Finally, there are examples of instruments utilized specifically for certain surgical specialties, like the Abadie clamp, used in digestive tract surgeries, or the Sluder-Ballenger tonsillotome, used for tonsil surgery[7].

The surgical instruments utilized in the hospital setting are seen as material resources and are of extreme importance within an institution, be it for profit or otherwise, since they represent 75% of the capital of health care establishments. Therefore, the way they are administrated reflects directly on the hospital's costs. Hence, an excess of instruments being processed and then left unused can result in an increase of costs, in addition to a depreciation, deterioration and waste of resources. To avoid this, instruments should not be found in excess in surgical boxes and operating tables, and only the indispensable instruments, which have been proven useful for the proposed surgical intervention, should be present[6,8].

In assessing the costs, it is extremely important to point out that the final product — in this case, the sterile hospital material — refers to three inter-related factors: utilized materials, manpower and the technology employed in the process. These factors, if well administrated, do not incur losses and guide the expectations for the reduction of costs, all the while maintaining the quality of care. To achieve this, the institution must have quality management that is aware of these factors[9].

To reach the total cost for sterilization, expenses with raw materials, manpower and work hours utilized in the process are calculated, from the washing of each instrument to the stocking of materials at the SSD, and assessing the technology employed for these steps — including here the maintenance of the sterilizer and the energy spent in this process[9,10].

In a study conducted in 2015, researchers found a cost of R$ 0.29 per processed instrument, identifying a total cost of R$ 1,584.17 for 17 medium surgeries performed during one month with the sterilization of instruments that were left unused in the surgeries, but which made up the surgical box[3].

Thoracic surgeries are an important specialty, as they offer interventions in the lungs, pleura, mediastinum and thoracic wall, accompanied by specialized medical staff made up of infectious disease specialists, oncologists and pulmonologists. Under this context, nurses practice complex perioperative nursing in surgeries like thoracotomy, bronchoscopy and lobectomy, among others[5].

A thoracic procedure includes the combination of delicate and heavy instruments utilized in incisions, dissections and retractions, as well as cutting and securing of tissue and vessels in the thorax, in addition to facilitating the inspection and the intervention of thoracic structures. Nurses are responsible for anticipating the need for these instruments and for providing them prior to surgery while avoiding waste; guaranteeing their appropriate and precise use during the

entire procedure, which generally involves long surgeries, guaranteeing that all of the instruments are meticulously checked and counted[5].

Thus, managing the materials in an operating room (OR) is the responsibility of the nurse who works in the SC and is a fundamental part of the perioperative nursing assistance, which involves the safety and care of patients during the preoperative, intraoperative, and postoperative stages[1-3].

For a well-designed and successful surgery, there should not be excess instruments in the operating tables. Only the instruments that are indispensable and which have been proven useful to the procedure should be present. Hence, the main question in this study is: Are all of the instruments that make up the surgical boxes for the thoracic surgeries utilized in the OR?

The results of this study will contribute to the improvement of the perioperative nursing practices regarding the assessment and control of instruments in the OR, in addition to providing assistance in controlling costs in the processing of instruments in the SSD.

OBJECTIVE

To assess the number of used and unused surgical instruments that make up the surgical boxes in thoracic surgeries.

METHODS

A descriptive, observational, cross-sectional study with a quantitative approach, conducted at a university hospital in Campinas (SP). It is a tertiary and quaternary care hospital, fully financed by the Unified Health System (SUS), and contains 403 beds, where all care is conducted and paid for exclusively by SUS. The SC performs an average of 200 surgeries per month, distributed among the 12 ORs for elective surgeries and 4 ORs for emergency procedures. The study was approved by the Research Ethics Committee of Universidade Estadual de Campinas, under protocol number 1.384.178, in January 6, 2016.

Data collection was conducted from February to April 2015, with the authorization of the SC Nursing Board and the nurses responsible for the sector, after the objectives of the study were presented and the Free and Informed Consent was read and signed. Thus, the ethical and legal precepts involved in studies with human beings, contained in Resolution 466/2012 from the National Health Council, were guaranteed[11].

The sample size was calculated considering the objective of estimating the proportion of surgical instruments left unused during thoracic surgeries from February to April 2015. For this calculation, a proportion of p equal to 0.50 was considered, which represents the maximum variability of a binomial distribution, thus generating an estimate with the largest sample size possible.

The population (N) considered when calculating the sample size was made up of 3,195 surgeries of any specialty, performed from February to April 2015, of which 336 were thoracic surgeries. In addition, a sampling error of 5% and a significance level of 5% were assumed. With this, the total calculated sample size was 343 surgeries. This sample was divided proportionally according to the number of surgeries performed and their specialties. For thoracic surgeries, the calculated sample was 30 surgeries.

The following was specified in the data collection instrument: name of the surgery, surgical boxes involved, date and number of surgery, identification of the most common instruments used in surgery by name — divided into incision, hemostasis, suture and ligation, others —; two columns indicating the quantity of each items in the box and the number of items that remained on the table after the end of the surgery; and finally, the sum of the values of both columns and a space for surgical observations.

The majority of surgeries need more than one box, so that each box coming from the SSD is accompanied by a list with the instruments present in each box. To collect the data, the researcher entered the OR during the surgery and, with the help of the lists, completed the first part of the data collection instrument, informing which instruments were available, as well as their quantity. At the end of the surgery, the researcher once again entered the OR and completed the second part of the instrument, registering the number of surgical instruments that remained intact in the boxes coming from the SSD; in other words, those that never touched the operating table.

In the data collection instrument for each surgery, surgical instruments were divided according to the surgical stages: incision, hemostasis, assistance, suture and litigation and others (including, mainly, instruments involved in exeresis). This process was implemented in 30 thoracic surgeries. Only the surgeries performed in the specialty "thoracic surgery" were considered for this study. At this institution this is the specialty that performs the tracheotomies.

RESULTS

From the 30 thoracic surgeries analyzed, a total of 3,333 instruments were observed, of which 516 (15.48%) were left unused. The mean of used instruments per surgery was 111.1, and the mean of unused instruments was 17.87 (Table 1).

The percentage of unused instruments in the thoracic surgeries corresponds to 15.48% (17.87), in 94 boxes observed within 30 procedures.

Minor, medium and major surgeries were performed: 8 tracheostomies (26.6%), 4 tracheoplasties (13.33%), 6 pleuroscopies (20%), 4 mediastinoscopies (13.3%), 3 lobectomies (10.0%) and 5 cystectomies (16.66%), utilizing 1 to 12 surgical boxes. Table 2 presents the distribution of the utilization of boxes and instruments for these specialties according to size and type of surgery.

The percentage of utilized instruments according to the surgical stage in these thoracic surgeries were: incision, 13,17%; hemostasis, 16,14%; assistance, 13,49%; suture and ligation, 11,41%; and other instruments, 19,39% (Table 3).

Hemostasis and other instruments stand out with the highest mean values for unused instruments, with 33.30 and

Table 1. Distribution of surgical instruments and boxes for thoracic surgeries. Campinas, 2016. (n=30).

Variable	Mean	Standard Deviation	Minimum	Maximum
Used Instruments	111.1	93.03	19.0	424.0
Unused Instruments	17.87	22.66	0.0	92.0
Number of Boxes Used	3.13	2.83	1.0	12.0

Table 2. Distribution of the total number of surgical instruments and boxes per surgery. Campinas, 2016.

Surgery	Surgical Instruments			
	Total Boxes	Initial Total	Unused	Used
Major				
Cystectomy	7	244	55	189
Cystectomy	6	214	53	161
Cystectomy	2	106	4	102
Cystectomy	7	424	30	394
Cystectomy	4	112	0	112
Lobectomy	10	220	48	172
Lobectomy	12	246	43	203
Lobectomy	6	206	0	206
Medium				
Tracheoplasty	2	108	0	108
Tracheoplasty	4	111	16	95
Tracheoplasty	4	209	82	127
Tracheoplasty	2	139	23	116
Minor				
Mediastinoscopy	4	123	14	109
Mediastinoscopy	1	37	17	20
Mediastinoscopy	2	65	0	65
Mediastinoscopy	2	122	12	110
Pleuroscopy	1	38	5	33
Pleuroscopy	2	65	10	55
Pleuroscopy	1	38	6	32
Pleuroscopy	2	73	0	73
Pleuroscopy	1	38	5	33
Pleuroscopy	1	22	2	20
Tracheostomy	1	38	5	33
Tracheostomy	1	115	25	90
Tracheostomy	2	32	6	26
Tracheostomy	1	29	0	29
Tracheostomy	2	64	42	22
Tracheostomy	1	19	1	18
Tracheostomy	1	28	3	25
Tracheostomy	2	48	9	39
Total	94	3333	516	2817

Table 3. Distribution of used and unused instruments by stage of surgery in thoracic surgeries. Campinas, 2016 (n=30).

Stages of Surgery	Surgical Instruments	Mean	Standard Deviation	Minimum	Maximum
Incision	Used	9.37	6.63	2.00	26.00
	Unused	1.67	2.64	0.00	10.00
Hemostasis	Used	33.30	21.77	7.00	80.00
	Unused	6.03	7.63	0.00	24.00
Auxiliaries	Used	20.33	14.24	6.00	57.00
	Unused	3.07	4.39	0.00	17.00
Suture or Ligation	Used	8.37	7.38	1.00	25.00
	Unused	1.53	3.76	0.00	20.00
Other	Used	39.73	69.07	0.00	363.00
	Unused	5.57	9.73	0.00	32.00

39.73 respectively, and they are also the instruments found in highest volume in the surgical boxes, as observed in Table 4, with 999 (29.97%) hemostasis instruments and 1,192 (35.7%) other instruments.

The instruments referred to as "other" were the highest number, because they refer to instruments for the "thoracic surgery" specialty, but not for the proposed surgery, such as retractors, clamps, specific forceps, sponge holders, collectors for cytological materials, distractors, tissue-unifying instruments, bone-cutting instruments, among others required to perform thoracic surgeries at this institution.

DISCUSSION

In a similar study — with similar objectives and methodology — conducted at a small hospital in the countryside of the state of São Paulo, a total of 52% of unused instruments were found, as well as a cost of R$ 0.29 per instrument processed by the SSD, when assessing only 17 medium surgeries performed during one month[3].

When discussing the costs involved in the processing of surgical instruments, there is a series of extremely costly variables, such as a multidisciplinary team made

Table 4. Distribution of used surgical instruments by surgical stage for each surgery. Campinas, 2016.

Surgery	Incision		Hemostasis		Auxiliaries		Suture or ligation		Other	
	Initial Total	Unused	Initial Total	Unused	Initial Total	Unused	Initial Total	Unused	Initial Total	Unused
Major										
Cystectomy	26	10	71	11	57	8	25	2	65	24
Cystectomy	23	4	71	18	55	17	24	4	41	10
Cystectomy	7	0	29	0	16	1	12	0	42	3
Cystectomy	11	0	15	0	26	0	9	0	363	30
Cystectomy	7	0	29	0	17	0	15	0	44	0
Lobectomy	22	4	46	16	29	7	17	1	106	20
Lobectomy	22	5	53	7	38	5	19	4	114	32
Lobectomy	19	0	49	0	31	0	14	0	93	0
Medium										
Tracheoplasty	8	0	45	0	27	0	8	0	20	0
Tracheoplasty	8	1	31	8	17	3	11	4	44	0
Tracheoplasty	14	9	80	24	34	15	23	20	58	24
Tracheoplasty	10	2	55	10	40	2	11	3	23	6
Minor										
Mediastinoscopy	7	1	37	9	21	4	8	0	50	0
Mediastinoscopy	5	3	20	11	10	3	2	0	0	0
Mediastinoscopy	4	0	20	0	10	0	3	0	28	0
Mediastinoscopy	8	0	52	2	38	4	12	3	12	3
Pleuroscopy	4	0	20	3	10	2	2	0	2	0
Pleuroscopy	12	3	25	3	15	0	3	0	10	4
Pleuroscopy	4	0	20	6	7	0	3	0	4	0
Pleuroscopy	4	0	17	0	10	0	3	0	39	0
Pleuroscopy	4	0	20	0	10	4	2	0	2	1
Pleuroscopy	6	0	9	2	6	0	1	0	0	0
Tracheostomy	4	0	20	0	10	3	2	0	2	2
Tracheostomy	9	0	80	23	15	0	5	0	6	2
Tracheostomy	8	2	10	1	6	1	4	2	4	0
Tracheostomy	3	0	14	0	9	0	1	0	2	0
Tracheostomy	7	4	26	22	18	10	5	2	8	4
Tracheostomy	2	0	7	0	6	0	1	0	3	1
Tracheostomy	3	0	14	2	7	1	2	0	2	0
Tracheostomy	10	2	14	3	15	2	4	1	5	1
Total	281	50	999	181	610	92	251	46	1192	167

up of professionals that process the materials, infectious disease specialists and surgeons, professionals who coordinate the control of infection, specific and environmentally controlled areas from the reception desk to the storage of supplies, meeting the manufacturer's specifications for the instrument, from its acquisition to strictly following the prior cleaning, transport, decontamination, inspection, functionality testing, packaging, decontamination and/or sterilization instructions, considering, furthermore, the quality of the water and the equipment used for individual protection by all of these professionals[5,12].

In a study with the objective of reducing the quantity of instruments in the surgical kits for adenotonsillectomies, which were frequently utilized by various surgeons, a prospective quality improvement method by Lean Six Sigma was employed, by mapping the flow of instruments regarding their use and processing. After the intervention, the number of adenotonsillectomy instruments were reduced from 52 to 24, with a reduction in the assembly time of these kits from 8.4 to 4.7 minutes ($p<0001$) and a decrease of 44% in the assembly cost, representing an estimate reduction of US$ 1,468.99 per kit[13].

It is important to consider that, in this same study, 700 adenotonsillectomy procedures were assessed during one year and 850 instrument kits were processed in the same year, being that the targets of intervention for the reduction of costs by the Lean method were: time wasted between the steps for the processing of instruments, transporting unnecessary components, superfluous and unused instruments, unnecessary activities related to the processing of components and unnecessary processing of unused instruments[13].

Thus, verifying unused instruments in certain procedures constitutes a valuable administrative tool that provides important information, with the aim of reducing costs in the processing of surgical instruments, as with the standardization of surgical kits for certain procedures, which is strongly recommended as long as there is a minimum amount and type of surgical instrument in each kit[5].

The instruments utilized from the category "others" of the stages of surgery (corresponding to the surgery itself) present a higher rate of unused instruments in relation to the instruments from remaining stages of surgery, as they are the instruments found in highest volume in the surgical boxes. This can be attributed to the standardization of surgical instruments that are specific to certain procedures, which does not consider a minimum composition recommended by the literature[5,13].

Higher rates of unused instruments were found for the hemostasis surgical boxes, which can be attributed to the use of new technologies, such as the electric scalpel, which presents not only the function of cutting tissue, thereby substituting the manual scalpel, but also the function of hemostasis, substituting hemostasis instruments as it is, above all, safer to handle[14].

This did not occur with suture or ligation instruments, which are found in these boxes at a lower volume and at a necessary ratio.

The operating rooms are hospital units that demand high costs and resources. In a study conducted with the objective of improving the multidisciplinary surgical process, a flow chart was constructed showing the entire surgical process, consisting of the rationalization of the preoperative process; a reduction of non-operative time; the elimination of redundant information; and encouraging the involvement of all employees. The improvements in the process were consecutively implemented by the surgical specialties. The main performance measures were collected before and after the implementation, resulting in improved efficiency and in improved financial performance. One of the actions conducted in this process was the meticulous description of surgical procedures, which allowed for careful anticipation and supply of materials utilized in the OR, considerably reducing the patient's and surgical staff's time in the OR[15].

The authors also observed that the mapping of these processes by a multi-professional team made up of anesthesiologists, surgeons, nurse anesthetists, nurse practitioners, allied health personnel, hospital administrators and systems analysts allowed for the process of information, leadership support, employee participation and the implementation of efficient performance measures, all key elements for improving the efficiency of an operating room, and guaranteeing substantial, sustainable and financially positive performance gains[15,16].

In one study that aimed to identify the types, quantities and costs of materials wasted in surgery in the intraoperative stage of a SC of a university hospital in São Paulo, 105 types of materials from 275 observed surgeries were assessed over a period of four months. Researchers identified that the most wasted items were surgical thread and gauze pads, at a total

cost of R$ 709.84. The study concluded that efficient management of material resources reduces the cost of these processes and reduces waste[17].

A study conducted in the SC in a public teaching hospital in Belém (PA), from July to August 2014, identified that the raw materials wasted during the surgeries were turbans (15%), gauze pads (13%), medication (12%), and gloves (11%). It can be concluded that this waste has a structural and administrative origin, and fighting it requires profound behavioral change from professionals, in addition to rigorous restructuring of the distribution system for materials to the SC. The study suggests the implementation of specific surgical kits for the procedures performed in the SC[18].

This study was limited to the thoracic surgery specialty and did not present variables like the costs generated by unused materials, neither did it investigate if the use or lack of use of these materials was related to the surgical team from that specialty. However, the study provided important information that can be used in future studies and extended to other specialties that work in the researched SC.

CONCLUSION

This study allowed for the quantitative identification of instruments left unused in thoracic surgeries and revealed a need to reformulate the surplus of instruments in the surgical boxes, with the purpose of reducing costs in the processing of instruments that make up these boxes and are left unused during the procedures.

The institutions will be able to reduce the costs of processing instruments by reviewing their work processes, which involves the participation of multi-professional teams working in the SC regarding the use of surgical instruments.

Based on these results, the restructuring of the surgical boxes for this specialty is being implemented as well as the gathering of costs for the processing of materials in the SSD and in the SC of this institution, with the purpose of organizing the work processes involving the administration of surgical instruments.

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