

# HIGH-COMPLEXITY ABDOMINAL SURGERY: CLASSIFICATION AND CHOICE OF EQUIPMENT BY THE MULTI-PROFESSIONAL TEAM

*Cirurgia abdominal de alta complexidade: classificação e escolha dos equipamentos pela equipe multiprofissional*

*Cirugía abdominal de alta complejidad: clasificación y elección del equipo quirúrgico por el equipo multiprofesional*

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**ABSTRACT: Introduction:** High-complexity procedures are characterized by the use of high-technology. The classification and choice of equipment are challenging for the professionals involved. **Objective:** To compare the classification of high-complexity abdominal surgeries and the choice of equipment by the multi-professional team between two hospital institutions. **Method:** Descriptive, quantitative, transversal and comparative research, with structured questionnaires on the opinion of surgeons, anesthesiologists and nurses. **Results:** The classification of procedures is similar when considering differentiated equipment ( $P < 1.0$ ) and physical structure ( $P = 0.172$ ). **Discussion:** The classification of more complex procedures is in agreement between professionals when compared to the legislation, even if not encompassing anesthetic dimensions, type of procedure or clinical conditions in their classification; the equipment is chosen by the professional who uses them, including operating rooms, with robotic surgeries being expendable to surgeons. **Conclusion:** There are differences between the choices made by health institutions, the availability of equipment and the types of abdominal surgeries. **Keywords:** Surgery department, hospital. Organization and administration. Surgical equipment. Surgical procedures, operative. Crew resource management, healthcare.

**RESUMO: Introdução:** Os procedimentos de alta complexidade são caracterizados pelo uso da alta tecnologia. A classificação e a escolha dos equipamentos são um desafio para os profissionais envolvidos. **Objetivo:** Comparar a classificação das cirurgias abdominais de alta complexidade e a escolha dos equipamentos pela equipe multiprofissional entre duas instituições hospitalares. **Método:** Pesquisa descritiva, quantitativa, transversal e comparativa, com questionários estruturados sobre a opinião dos cirurgiões, anesthesiologistas e enfermeiros. **Resultado:** A classificação dos procedimentos é semelhante quando levados em conta equipamentos ( $P < 1,0$ ) e estrutura física ( $P = 0,172$ ) diferenciados. **Discussão:** A classificação dos procedimentos mais complexos tem concordância entre os profissionais comparado à legislação, mesmo não englobando o porte anestésico, tipo de procedimento e condições clínicas na sua classificação; a escolha dos equipamentos é do profissional que os utiliza, incluindo amplas salas de operações, sendo a cirurgia robótica dispensável aos cirurgiões. **Conclusão:** Há diferenças entre instituições de saúde em relação à escolha, à disponibilidade de equipamentos e aos tipos de cirurgias abdominais.

**Palavras-chave:** Centro cirúrgico hospitalar. Organização e administração. Equipamentos cirúrgicos. Procedimentos cirúrgicos operatórios. Gestão de recursos da equipe de assistência à saúde.

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**RESUMEN:** **Introducción:** procedimientos de alta complejidad se caracterizan por el uso de alta tecnología. La clasificación y elección de los equipos son un desafío para los profesionales. **Objetivo:** comparar la clasificación de cirugías abdominales de alta complejidad y la elección del equipo por parte del equipo multiprofesional entre dos instituciones hospitalarias. **Método:** investigación descriptiva, cuantitativa, transversal y comparativa, con cuestionarios estructurados sobre la opinión de cirujanos, anestesiólogos y enfermeras. **Resultados:** la clasificación de los procedimientos es similar cuando se consideran equipos diferenciados ( $P < 1,0$ ) y estructura física ( $P = 0,172$ ). **Discusión:** la clasificación de procedimientos más complejos está de acuerdo entre los profesionales en comparación con la legislación, incluso si no abarca dimensiones anestésicas, tipo de procedimiento o condiciones clínicas en su clasificación; el equipo es elegido por el profesional que los utiliza, incluidos los quirófanos, y las cirugías robóticas son dispensables para los cirujanos. **Conclusión:** hay diferencias entre las elecciones realizadas por las instituciones de salud, la disponibilidad de equipos y los tipos de cirugías abdominales. **Palabras clave:** Servicio de cirugía en hospital. Organización y administración. Equipo quirúrgico. Procedimientos quirúrgicos operativos. Gestión de recursos de personal en salud.

## INTRODUCTION

Surgical procedures are the main financial source of a hospital, whether public or private ones<sup>1</sup>. Surgeries are classified as small, medium and large sized by the Ministry of Health (MoH)<sup>2</sup> and by the Brazilian Medical Association (*Associação Médica Brasileira — AMB*)<sup>3</sup>. The MoH made a modification in the Unified Health System (*Sistema Único de Saúde — SUS*) through ministerial ordinances regarding this classification, which would then be grouped into small-, medium- and high-complexity (HC) surgeries. The time of surgery and the contamination potential continue to classify the procedures and the risk of infection. For the AMB, the classification of a surgery into small, medium or large sized remained and was added of a table of Brazilian Hierarchical Classification of Medical Procedures (*Classificação Brasileira Hierarquizada de Procedimentos Médicos — CBHPM*) and Unified Terminology of Health Services (*Terminologia Unificada de Serviços de Saúde — TUSS*) with anesthetic dimensions from 0 to 8, 0 being local anesthesia in ascending order up to 8, representing transplants with combined anesthesia<sup>3</sup>.

The first surgical specialty to be modified with the size classification for HC in the SUS was orthopedics, in 1994<sup>4</sup>, followed by oncology<sup>5</sup>, heart surgeries<sup>6</sup>, brain surgeries<sup>7</sup>, lip-palatal lesions<sup>7</sup>, oral osteointegrated implants<sup>7</sup> and transplants<sup>7</sup>. The MoH, in order to ensure SUS's access to specialized services, defined outpatient and hospital HCs — Ordinance No. 3.535, in 02/08/1998<sup>5</sup> — as: “HC centers are hospitals which offer specialized and integral assistance to patients with certain diseases, working in the prevention, early detection, diagnosis and treatment of the patient”. The HC care model defined that a HC unit must have

adequate technical conditions, physical facilities, equipment and human resources in order to provide specialized assistance. The MoH defined HC as a set of procedures which, in the context of SUS, involves high technology and cost with the objective of providing the population with access to qualified services, integrating them to other levels of health care (basic and medium-complexity).

Strategical procedures were reclassified as HC to optimize surgical taskforce, such as varices, hernias and urological surgeries<sup>8</sup>. Bariatric surgeries, for instance, went from strategic procedure to HC in 2007<sup>9</sup>. Digestive tract surgeries remained categorized as of medium complexity, with the exception of oncological indication, which is of HC despite using the same equipment.

Due to the need of control and the institution of rules for the private health sector by the MoH, the Law No. 9.656, of 06/03/1998<sup>10</sup>, was established, regulating health insurance operators and organizing new companies in the segment. The National Agency for Supplementary Medicine (*Agência Nacional de Medicina Suplementar — ANMS*), created in 2001 and subordinate to the MoH, established HC to complementary medicine of the private health system and instituted a list of procedures to improve remuneration in the segment<sup>11</sup>.

The difference in the classification of surgical procedures as of medium- and high-complexity with remuneration tables in both public and private segments is significant. There is a large discrepancy in the numbers passed on to healthcare institutions of SUS, which shows the low funding of public services and the undervaluation of health in Brazil. In the private sector, large-scale procedures are better remunerated by healthcare providers, according to CBHPM and TUSS tables, resulting in competition among

hospital institutions to provide the population with the latest technology for the choice of teams and clients. In the public sector, there is great difficulty in the access of the population to more qualified health services, with idleness in the use of existing equipment and resources. The lack of basic material and equipment reflects the reality of health segments and demonstrates the undervaluation of care in Latin America<sup>12</sup>.

A HC organization needs technical support, physical and material structure and human resources. Similar structures are necessary for both high and medium complexity procedures. After all, large-sized procedures by the AMB table, such as hepatic, esophageal, pancreatic and coloproctological abdominal surgeries, which are of medium complexity in SUS, require specific skills and knowledge from the teams involved due to technical and anesthetic difficulties and prolonged surgical time. Emergency surgeries remained as of medium complexity due to their requiring basic equipment and an operating room (OR)<sup>13</sup>.

Robotic surgeries have been spread worldwide, as well as minimally invasive surgeries of access to the population in all social strata. However, in Brazil, the cost for a robotic system is rather high and limited to few private and public institutions. The SUS considers the differences between high and medium complexity by using of the latest equipment and a chart with the relative costs for the procedure. The technology would be the differential between medium- and high-complexity procedures.

An extremely simple procedure, though using recommendable equipment, may be considered of HC. It demonstrates the misconceptions of the table, such as costly and highly complex procedures being listed alongside other simple and of low complexity ones. In order to ensure the implementation of HC services and anesthetic-surgical safety, the MoH proposed the minimum equipment for patient safety in a HC surgical center (SC) in oncology and neurosurgery in Brazil<sup>14</sup>.

The organizational structure of a SC encompasses the surgical, anesthetic and nursing teams. Any OR is organized by the nursing teams and named “standard room”<sup>14</sup>, according to the small-, medium- or large-sized procedures determined by the Collegiate Board Resolution (*Resolução da Diretoria Colegiada — RDC*) No. 50<sup>15</sup> and by the *Handbook of Best Practices of the Brazilian Association of Nurses of Surgical Center, Anesthetic Recovery and Material and Sterilization Center (Associação Brasileira de Enfermeiros de Centro Cirúrgico, Recuperação Anestésica e Centro de Material e*

*Esterilização — SOBECC*). The American Agency of Health Administration published the intermediate standard and surgical complexity for regulating procedures, which is necessary for an operating room<sup>16</sup>.

Considering all the variables presented, there is a difficulty in characterizing what is effectively needed in terms of equipment to compose an OR for HC procedures<sup>17</sup> — there should be the latest generation of equipment and technology, with the indication of what is indispensable, necessary or recommendable for the procedures. Despite the annual evolution and innovation, according to the practices recommended for ORs, there is no need for replacement or acquisition of these equipment; the technology should be contextualized to the whole clinical and multi-professional team, so that their use compensates the cost. In the public sector, they are not made available by the institution and are not necessary for the procedure. Supplying equipment in the private segment depends on acquisition and release for use by healthcare providers due to their high cost<sup>18,19</sup>.

## OBJECTIVE

The objective of this study was to describe the definition and classification of HC abdominal surgeries and the choice of equipment according to the multi-professional team between two hospital institutions.

## METHODS

The research is descriptive, quantitative, cross-sectional and comparative. It was carried out in two SCs: (A) a private, philanthropic, extra-sized, quaternary care hospital; (B) a private, philanthropic, large-sized hospital, with private healthcare insurance. Inclusion criteria included being active surgeons in the area of general and digestive system surgery and transplants, hired nurses and anesthesiologists, working in SC and present in data collection days, authorized by the Scientific Commission of the Institution, according to the Project approved by the Research Ethics Committee (CEP): protocol CEP 370/10 of Institution A and CEP 11/10 of Institution B. Exclusion criteria considered professionals working exclusively with outpatient surgeries and who did not hand in the questionnaires within 30 days.

## RESULTS

Data collection was carried out through a structured questionnaire personally handed to each of the professionals. In institution A, there was the total of 82 questionnaires to surgeons, 50 to anesthesiologists and 22 to nurses, while in institution B, 123 questionnaires to surgeons, 108 to anesthesiologists and 26 to nurses. It was a simple and random sample, comprising the questionnaires returned, totaling: 25 surgeons in A and the same amount in B, of which 13 general surgeons and/or digestive tract staff and 12 transplant professionals; 25 anesthesiologists in A and 21 in B; and 22 (A) and 24 (B) nurses.

The validation of contents of research instruments and of the form from the first to the second version of the questionnaire was carried out with the aid of specialists in the SC segment through the Delphi technique. Due to similarities in open questions and answers, there were closed questions. The pre-test was a descriptive study, and a statistical test was not performed in the first phase with specialists, contemplating data of the institution, identification, concept and HC classification, equipment, staff training, human resources and furniture according to clinical practice, literature and legislation. Initially, the questions were opened in a descriptive way, which was changed into a structured questionnaire with closed questions in the second phase and including five categories: definition of HC (nine questions), equipment needed and/or recommended to the procedures mentioned and/or used by the many multi-professional teams (33 items), physical blueprint of the OR (two questions), academic training (one question) and types of surgical procedures (15 items). Two categories were included for nurses: assembly of furniture in an OR (10 items) and the role of nurses in SCs (six items and seven questions).

The structured questionnaires for nurses contained 82 items and 12 questions; for surgeons, 60 questions; and for anesthesiologists, 12 questions and 59 items.

The period of data collection began in 2012, after approval of CEP, in institutions A and B, with 417 returned and 142 answered questionnaires; the devolution of 50 blank forms, mostly by institution B. The questionnaires were tabulated in a database, in an Excel spreadsheet, and classified into six categories: surgeons, anesthesiologists and nurses in institutions A and B. The Pearson's  $\chi^2$  test was used, when necessary, and the Fisher's exact test was performed regardless of the category, adopting the significance level of 5% for all.

The total of 417 questionnaires were distributed, and 142 (34%) were returned, answered and tabulated in Excel databases, classified into three categories for each of the institutions: surgeons, anesthesiologists and nurses. The profiles of surgeons were grouped according to their origin (50% institution A and 50% B); age (between 30 and 40 years in institution A and above 40 years in institution B); area of work — with prevalence of surgeries of the digestive tract in institution A (36%) and transplantations in institution B; time and area of work — over 10 years in both institutions. The same way, anesthesiologists were grouped according to their origin (54.3% institution A and 45.7% B); age (between 31 and 40 years in both institutions); general anesthesia specialty, with 84% in institution A and 81% in B; time of work in anesthesia — over six years in institution A (72%) and between six to ten years in institution B (66%). Finally, nurses registered the following numbers: 22 (47.8%) from institution A and 24 (52.2%) from B; aged over 31 years (72.7%) in institution A and 21 (87.5%) in B, with the highest percentage of individuals under 30 years of age in institution A, totaling 6 (27%); specialization in SC, with 54.5% in institution A and 95.8% in B; time of academic training of up to five years (36.3%) and over 10 years (45.5%) in institution A, different from B, in which 60% of nurses have from six to ten years of training, 17.4% have up to five years; and 21.8% have more than ten years.

Tables 1 to 3 describe, respectively, the concept and classification of HC procedures, the choice of surgical equipment and non-coincident answers regarding robotic surgery, standard OR determination for HC, recommended choice of equipment and blueprints of the physical space.

Surgeons, anesthesiologists and nurses agree with the division of surgeries in HC and a subdivision and listing of abdominal procedures. Only specific surgeries with large resections were considered of HC, such as hepatic, esophageal, coloproctological, pancreatic and gastric surgeries and transplants. The listing is important in order to determine the procedures by their technical difficulty based on the experience of the professionals. Surgical time, use of high-cost technology and anesthetic dimensions were not determinant in the classification of HC procedures, as opposed to clinical conditions.

The propulsion pump for extracorporeal circulation, the dialytic ultrafiltration and the radiofrequency are devices

of few use to abdominal procedures. The cell saver system is used by only 21% of the surgeons in institution B, as oppose to institution A, due to its being unavailable. Only 16% of surgeons in institution B indicated unavailability due to lack of staff for their use, while 30% reporting not

having needed to, 21% having used it and 49% may be dispensable and are not used.

Regarding the physical space, the blueprint was considered satisfactory by 100% of professionals in institution A and 80% in B, though the OR should be larger. For

**Table 1.** Concept and classification of high-complexity procedures according to the multi-professional team — São Paulo, 2012.

Classification	Surgeons A	Surgeons B	Anesthesists A	Anesthesists B	Nurses A	Nurses B	p-value
Concept of medium and high complexity	Concordance 96%	Concordance 88%	Concordance 68%	Concordance 90%	Concordance 100%	Concordance 72%	>0.05
Division, subdivision and listing	94%	94%	94%	94%	94%	81%	>0.05
Clinical condition	71%	85%	80%	45%	85%	100%	>0.05
Anesthetic dimension	67%	92%	76%	60%	81%	90%	>0.05
Surgical time	62%	83%	76%	40%	76%	80%	>0.05
High-cost technology	55%	30%	60%	70%	38%	30%	>0.05

**Table 2.** Choice of equipment used in high-complexity surgery according to the multi-professional team — São Paulo, 2012.

Equipment	Surgeons A	Surgeons B	Anesthesists A	Anesthesists B	Nurses A	Nurses B	p-value
Videolaparoscopy	92%	92%	Do not use	Do not use	100%	92%	>0.05
Microscope	75% Not necessary	73% Not necessary	64% Not necessary	64% Not necessary	100% Not necessary	91% Not necessary	>0.05
Single/bipolar scalpel	90%	90%	64% not of high complexity	57% not of high complexity	100%	100%	=0.488
Ultrasonic scalpel	80%	Unavailable	Indifferent	Indifferent	Unavailable	70%	=0.012
Water jet scalpel	60%	20%	60%	Indiferente	80%	70%	=0.03
Dialytic ultrafiltration	16.4%	12.5%	36%	36%	4.8%	33.3%	>0.05
Electro stimulator	41.2%	41.2%	100%	100%	95.2%	83.3%	>0.05
Biopump*	41%	12%	36%	36%	100%	85%	>0.05
Radiofrequency	52%	37%	36%	36%	71%	83%	>0.05
Scoping and image enhancement	79.2%	73.9%	36%	36%	100%	91.6%	>0.05
Cell saver**	Unavailable	21%	Unavailable	100%	Unavailable	100%	>0.05

\*Propellant pump for extracorporeal circulation; \*\*system for blood reuse.

## DISCUSSION

nurses, coincident answers in relation to the organization and management of the segment were observed: all were favorable to the purchase of equipment; elaboration of assistance and safety operational protocols; organization of the map of surgeries; participation in organizing the structure from the blueprints, to the implementation of a SC with proper OR preparation with basic standard equipment, not waiting for the medical team to choose the OR and their use for the different types of procedures. Nurses and surgeons, rather than anesthesiologists, determine the OR to be used. The robotic surgery was considered expendable for 70% of surgeons and nurses in institution A and 60% in B, unlike the nurses in institution B, where 77% of them find robotics necessary, available and of restricted use due to technical difficulty and lack of coverage by private health insurances.

Medium and HC procedures are seen differently from a unit with SUS care for supplementary health system. Although data collection was performed over five years ago, the theme remains a concern due to SUS's table not including complex procedures compatible with the remuneration of the public system, which is, in fact, necessary, so that an OR ensures the anesthetic-surgical safety with material and human resources and is considered sufficient to the procedures<sup>14,16,17</sup>.

The structure for the standard surgery room is part of the handbook for best practices of SOBECC<sup>17</sup>, which describes the minimal furniture and equipment, and reflect that not all available technology is necessary. In the case of private health insurances, there are procedures and equipment which are not included in surgeries and which depend on

**Table 3.** Non-coincident answers regarding robotic surgery, determining a high-complexity standard operating room, choice of recommended equipment, blueprints and emergency surgeries for surgeons, anesthesiologists and nurses — São Paulo, 2012.

High-complexity procedures	Category	Surgery					Anesthesia					Nursing				
		A		B		Valor p	A		B		Valor p	A		B		p-value
		Quantity	%	Quantity	%		Quantity	%	Quantity	%		Quantity	%	Quantity	%	
Do you consider robotic surgeries a need?	Yes	8	32.0	11	39.1	0.679*						5	22.7	15	62.5	0.017*
	No	17	68.0	14	60.9		NA		NA			17	77.3	9	37.5	
Do you usually determine the operating room to high-complexity procedures?	Yes	12	48.0		28.0	0.172*						20	90.9	22	91.6	<1.0**
	No	13	52.0	18	72.0		NA	NA	NA			2	9.1	2	8.4	
Are the recommended equipment chosen at your discretion?	Yes	21	84.0	25	100	<1.0**	23	92.0	21	100	<1.0**					
	No	4	16.0	0			2	8.0					NA	NA		
Is a standard operating room prepared with basic material and equipment?	Yes	21	84.0	24	96.0	0.348*	18	72.0	18	85	0.303*	19	81.0	22	91.6	<1.0**
	No	4	16.0	1	4.0		7	28.0	3	15		3	19.0	2	8.4	
Do you consider the blueprint of the surgical center physical space enough for the needs of the services provided?	Yes	19	76.0	23	92.0	0.245*	21	88.0	17	81.0	0.513*	19	81.0	22	91.6	0.067*
	No	6	24.0	2	8.0		4	12.0	4	19.0		3	19.0	2	8.4	
Are emergency surgeries highly complex?	Yes	16	64.0	12	48.0	0.312*	10	40.0	10	47.6	0.736*	12	54.5	17	70.8	
	No	9	36.0	13	52.0		15	60.0	11	52.4		10	45.5	7	29.2	

Source: Institutions A and B.  
\* $\chi^2$  test; \*\*Fisher test; NA: not applied.

authorizations issued by insurance companies in the segment. The comparison between philanthropic institutions made possible the description of the difference between surgeries of public and private segments. There are differences between the quantity and types of equipment, furniture and availability of latest technologies. In the private sector, assets which are not used for all procedures, however available, include robotics surgery, blood reuse equipment and brain monitoring systems. In the public segment, some equipment is available, though not in enough numbers for all ORs. The surgeons in institution B considered the cell saver as little used for HC abdominal procedures; it is available according to the preferences of surgeons<sup>20</sup>.

Robotic surgery has been evolving as professionals improve their technique, being available in some private and public health institutions, which use it in an experimental and academic way. Hybrid rooms and the types of surgery evolve according to the technology available in the market<sup>18,19</sup>.

According to the answers, the choice of recommended equipment by the professional discretion doesn't always occur. The funding system of the institutions is determinant for the coverage and availability of the equipment<sup>13</sup>. Institution A, as a teaching institution, allows greater decision power regarding the equipment used by availability, not depending on authorization for their use by private health insurances. For the anesthesiologists of institution B, where all necessary equipment for anesthetic safety is available, there is no difference in the anesthesiologic criteria for the clinical conditions, and the surgical time is shorter, resulting in greater procedure safety. Technology innovates, but it is not always necessary, although it can assist professionals in providing better care. Anesthesiologists do not have a say on the equipment used by the surgeons, who, in turn, do not comment on the type of monitoring; each one plays their part. Nurses have autonomy in the OR decision along with the whole multi-professional team.

In institution A, ORs are sized for medium complexity surgeries and are not sufficient for complex surgeries requiring other equipment. The concern regarding limitations in human resources and the need to resize based on the dimensions and complexity of the procedure occurs in other countries<sup>16-19</sup>. The classification should include anesthetic dimensions and clinical conditions, as well as the U.S. Department of Public Health Administration Guidelines<sup>16</sup>, published in 2010 and which defined the standards for surgical size.

A standard OR is prepared with recommended material and equipment aggregated to other technologies according to the need for use and their availability to the procedure according to SOBECC's Best Practices Handbook<sup>17</sup> and new OR technology<sup>18</sup>. The rules for health facilities, according to RDC No. 50, of 02/05/2002<sup>15</sup>, should be followed, addressing large ORs to large-sized procedures — even 15 years after the regulation, these changes are yet to be made.

The limitations of the study are restricted to the institutions in which professionals work, but they reflect the reality of difficult access to technology and/or their availability without the use of high-cost equipment. The resistance for approval in other CEP of private institutions, in which comparisons may result in administrative conflict of interests and relate it to public health services, there might be negative results. The work should be expanded to philanthropic, public and private institutions with private health insurances, in which the limitations and availability of equipment are greater.

## CONCLUSION

The data define there are differences between ORs of public and private institutions in Brazil. The definition and classification of HC procedures are important in order to structure the surgical environment from 1994 to 2012, according to the legislation. The HC concept was considered incomplete by the professionals since they do not include anesthetic dimensions, the type of procedure and clinical conditions. The surgical time is relevant for the classification of procedures; equipment are determined by the professionals who use them and should be made available by the institution; emergency surgeries were not considered as of HC, once they use basic equipment as in medium-complexity procedures and do not use the latest technology in which the lack and/or scarcity of materials is more evident.

Considering the option of a standard OR with basic equipment and reduced physical space, emergency surgeries may be carried out in OR not designed for HC procedures if not planned in advance, with higher anesthetic risk, and discard the use of recommended equipment used in elective procedures. The complementation of training in surgical center specialties is essential when regarding HC procedures. The robotic surgery is a technology that has evolved, although it is still considered expendable to physicians.

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