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REVIEW ARTICLE

Endoscopic processing: what are the gaps in clinical practice?

Processamento endoscópico: quais são os gaps na prática clínica?

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ABSTRACT

Objective: This paper aimed to identify gaps in clinical practice that interfere with the effectiveness of endoscopic processing. **Method:** Integrative review of articles published between 2008 and 2020, identified in databases through controlled descriptors in Health Sciences, adopting the PICO strategy. The identified gaps were classified according to the level of evidence (IA, IB, IC, II). **Results:** Eighteen articles were found, recording 64 gaps, 26.6% at the level of evidence IA and 40.6% IB, predominating: absence/inadequate drying (55.5%), manual cleaning without brushing the inappropriate channels/brushes (50%), omission of the sealing test (38.8%), inadequate storage (33.3%) and use of the disinfectant solution (27.7%), time of immersion or monitoring of the minimum effective concentration, absence of pre-cleaning (16.6%), incorrect transportation to the processing room (11.1%). **Conclusion**: It was concluded that guidelines strongly recommended by international and national entities have been breached, representing critical aspects in the processing of endoscopes that imply potential failures in patient safety.

Descriptors: Endoscopes, Gastrointestinal; Disinfection; Sterilization; Infection Control.

RESUMO

Objetivo: Identificar na prática clínica *gaps* que interferem na efetividade do processamento endoscópico. **Método:** Revisão integrativa de artigos publicados entre 2008–2020, identificados em bases de dados por meio de descritores controlados em Ciências da Saúde, adotando-se a estratégia PICO. Os *gaps* identificados foram classificados segundo nível de evidência (IA, IB, IC, II). **Resultados:** Foram encontrados 18 artigos registrando 64 *gaps*, 26,6% no nível de evidência IA e 40,6% IB, predominando: ausência/inadequação da secagem (55,5%), limpeza manual sem escovação dos canais/escovas inapropriadas (50%), omissão do teste de vedação (38,8%), inadequações no armazenamento (33,3%) e no uso da solução desinfetante (27,7%), tempo de imersão ou monitorização da concentração mínima eficaz, ausência de pré-limpeza (16,6%), transporte incorreto para a sala de processamento (11,1%). **Conclusão:** As diretrizes fortemente recomendadas por entidades internacionais e nacional têm sido descumpridas, representando aspectos críticos no processamento dos endoscópios que implicam em potenciais falhas na segurança do paciente.

Descritores: Endoscópios Gastrointestinais; Desinfecção; Esterilização; Controle de Infecções.

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How to cite this article: Madureira RAS, Oliveira AC. Endoscopic processing: what are the gaps in clinical practice? Rev. Eletr. Enferm. [Internet]. 2021 [cited on: _____];23:66550. Available at: https://doi.org/10.5216/ree.v23.66550

Received on: 11/08/2020. Accepted on: 03/22/2020. Available on: 06/15/2021.

INTRODUCTION

Diagnostic and therapeutic procedures, using flexible and rigid endoscopes, have been increasing annually worldwide[1]. It is estimated that each year, in the United States, more than 17 million endoscopic procedures are performed[2]. In Brazil, according to information from the Ministry of Health, between January 2015 and July 2020, the Unified Health System (Portuguese acronym: SUS) registered: 6,047,175 upper gastrointestinal endoscopy exams; 1,604,464 colonoscopies and 44,153 endoscopic retrograde cholangiopancreatographies[3]. However, it is known that this quantity probably does not represent the total number of exams in the country, considering that the procedures performed by medical insurance or private services are not included.

Endoscopy consists of a minimally invasive procedure, which allows the visualization of organs and cavities, facilitating the early diagnosis and treatment of several comorbidities[4].

However, endoscopic equipment has a complex structure, consisting of multiple long channels, with narrow lumens, which makes access difficult, and can compromise its cleaning and disinfection[1,5,6]. During the examination, gastrointestinal endoscopes can become highly contaminated[7-9], reaching a substantial microbial load that can vary between 6×10^4 to 3.7×10^8 CFU/mL[10]. This contamination occurs due to the path of the equipment, as it establishes direct contact with blood, secretions and potentially pathogenic microorganisms such as *Streptococcus spp., Staphylococcus spp., Escherichia coli, Klebsiella spp.* and *Helicobacter pylori*[10,11].

Considering that endoscopes are reusable, careful processing is essential to prevent cross-infection[1,12,13]. Processing consists of numerous steps[6,14,15] and it is known that failures in any one of them can compromise the safety of their use among patients, being decisive in the transmission of multi-resistant microorganisms, as in the outbreaks in the United States[16] and Europe[17].

Despite the challenges imposed by processing and the occurrence of potential cross-contamination, the risk of adverse events related to the endoscopy procedure has been considered as one case per 1.8 million procedures[18,19]. However, this data may be underestimated, as there is no defined standardized surveillance model in endoscopy services, in addition to factors that make reporting difficult, as many complications related to the procedure, such as infections, can most often occur late (up to 13 months after the procedure)[20], making it impossible to correlate and establish the epidemiological link between the infection and the procedure[21,22].

Concerns about this scenario have been raised by international organizations and societies[12,13,16,23], such as the Emergency Care Research Institute (ECRI), an American Institute whose mission is to protect patients from unsafe medical technologies and practices, which pointed out from 2011 to 2019 the failures in the processing of endoscopes among the 10 most challenging health technologies[24].

In this context, this study aimed to identify in clinical practice what are the gaps that can interfere with the effectiveness of endoscopic processing.

METHOD

It is an integrative review of the literature, whose purpose was to compile results of original research that can contribute to the deepening of knowledge on the topic, based on the following guiding question: What are the gaps in clinical practice that can interfere with the effectiveness of processing of gastrointestinal endoscopic equipment?

To answer the research question, the literature review was based on the search for studies that addressed potential gaps in the processing of endoscopes, which could put patient safety at risk. To select search descriptors, the PICO strategy[25] was adopted: P (Population) = gastrointestinal endoscopes; I (Intervention) = disinfection, sterilization; C (Comparison) = not applicable; O= (Outcomes) = infection, contamination.

To identify the gaps and recognize the main bottlenecks in the processing of endoscopes, we chose to consider the processing steps described below: pre-cleaning, sealing test, manual cleaning, automated cleaning, disinfection, rinsing, drying, storage and traceability.

The search for articles was carried out in the portal Coordination of Superior Level Staff Improvement (Portuguese acronym: CAPES) library and in the Virtual Health Library (VHL); using the electronic bases: U.S. National Library of Medicine (PubMed), Cochrane, SCOPUS, Web of Science and Latin American Literature in Health Sciences (LILACS). The following controlled descriptors contained in the Health Sciences Descriptors (DeCS) and Medical Subject Headings (MeSH) were used for the selection of articles: *endoscópios gastrointestinais* (gastrointestinal endoscopes), *desinfecção* (disinfection), *esterilização* (sterilization) and *controle de infecções* (infection control), as well as the corresponding terms in English and Spanish. Original articles published from 2008 to 2020 that addressed the gaps found in clinical practice on the stages of processing gastrointestinal endoscopes were established as inclusion criteria. 2008 was the period of registration, in Europe and the United States, of the first outbreaks related to the transmission of microorganisms after endoscopic procedures and associated with processing failures.

Based on this strategy, 516 articles were identified, of which duplicates and those that did not meet the scope of the research were excluded, considering the reading of the titles and abstracts, leaving 117 articles. The identification and selection process of the articles was carried out by one of the authors, who, after reading in full, excluded 93 articles,

as they did not specifically describe the gaps related to the processing of gastrointestinal endoscopes, thus totaling a sample of 18 articles, as can be seen in Figure 1.

The studies were classified according to the level of scientific evidence, according to the assessment of reliability and validity, which considers the methodological approach and the research design employed: Level 1: evidence resulting from the meta-analysis (controlled and randomized clinical studies); Level 2: evidence obtained from studies with experimental design; Level 3: evidence from quasi-experimental studies; Level 4: evidence from descriptive studies (not experimental) or with a qualitative approach; Level 5: evidence from case or experience reports; Level 6: evidence based on expert opinions or consensus[26].

RESULTS

The sample consisted of 18 articles, with the largest number of publications in 2018 (5/18), followed by 2017 (3/18), 2013 (3/18) and 2010 (3/18), 2011 (2/18), 2015 (1/18) and 2008 (1/18). The countries that originated the publications were: United States (4/18), France (4/18), Brazil (3/18), Italy (2/18), Egypt (1/18), Scotland (1/18), China (1/18), Portugal (1/18) and a worldwide study covering 39 countries.

As for the research design, the majority (n=13; 72.2%) of the studies were classified as descriptive (cross-sectional, control-case and prospective), corresponding, therefore, to level 4 of evidence. Only one study was considered to be level 2, as it is experimental and the others (n=4; 22.2%) were classified as level 5, as they are reports and case series.

Given the assumption of the PICO strategy, below are presented all studies, according to the type of equipment, gaps found and their respective outcomes (Chart 1).

It is noteworthy that with regard to the outcomes, it was observed that six studies (33.3%) pointed to the occurrence of infectious outbreaks among patients after the endoscopy procedure[20,31,32,35,37,42], 4 articles (22.2%) mentioned evidence of contamination in the ready-to-use equipment[27,30,33,36] and 8 studies (44,4%) evaluated only problems related to processing without investigating the outcome[28,29,34,38-41,43].

Considering all the processing steps, there was a predominance among the analyzed studies of failures in the drying step (55.5%), followed by the manual cleaning step (50%), sealing test (38.8%), storage (33.3%), disinfection (27.7%) and automated cleaning (22.2%). In addition, less frequently in the stages of pre-cleaning (16.6%), transport of

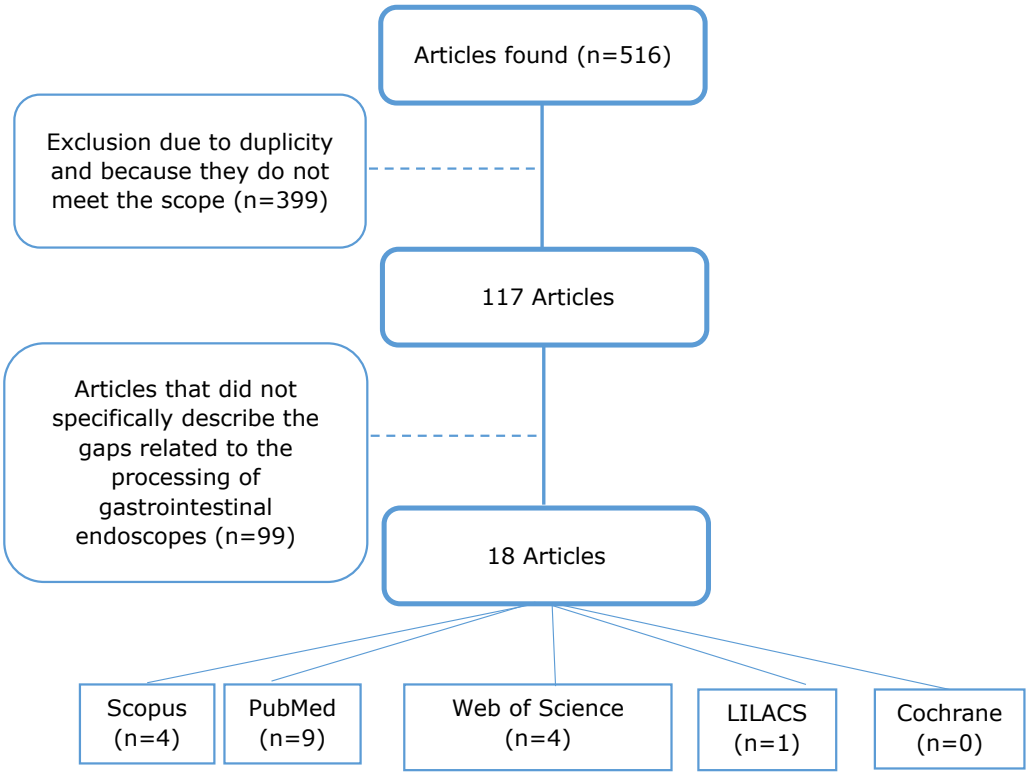

Figure 1. Strategy for the selection of articles. Belo Horizonte, MG, Brazil, 2020.

the endoscope from the point of use to the processing room (11.1%) and traceability (5%). A detailed description of all gaps found, according to the processing stage, is presented in Figure 2.

Among the 18 studies analyzed: the non-performance of the sealing test (33%), the absence of drying of the equipment before disinfection (22%), the absence of brushing of all channels (17%), together with the non-monitoring the minimum effective concentration of the disinfectant (17%) and the storage of the endoscope in an inadequate position (17%) were the main highlights.

The gaps identified in the articles were also analyzed in accordance to the scientific recommendations contained in the Guidelines, according to their respective levels of evidence, divided into categories IA, IB, IC and II. These classifications are used to demonstrate which measures have the best scientific evidence for applicability in clinical practice[5,44], as shown in Figure 3.

It is also important to highlight that, in the studies analyzed, 64 gaps were identified, distributed in nine processing stages. Thus, it was found that professionals ignored guidelines strongly recommended. Such recommendations correspond to the level of evidence IA and are related to the disinfection stages (9%), such as, for example, filling the channels of the endoscopes with disinfectant solution and monitoring its minimum effective concentration; in addition to the drying step (17%), as an example, proper drying of the equipment before storage.

Concerning the level of evidence IB, guidelines regarding the pre-cleaning steps (5%), were ignored, such as its performance with the equipment disconnected to the light source, added to the execution of the sealing test at each cleaning of the equipment (9%), in addition to the manual cleaning step (20%), with emphasis on critical points such as friction of the entire external and internal surface of the equipment, including the elevator channel. It is known that such recommendations are of great relevance to clinical practice and aim to contribute to the effectiveness of processing. If not followed, they may jeopardize safety in the use of endoscopes.

DISCUSSION

Concerns about the processing of gastrointestinal endoscopes have been increasingly highlighted among the scientific community concerned with this topic, in addition to being the focus of discussions between international organizations, institutions and societies (ECRI)[13,15,24].

The effectiveness of the processing of endoscopic equipment is fundamental for the safety of patients. Thus, to guide the teams of the endoscopy services with respect to good processing practices, guidelines and recommendations based on evidence are instituted by several societies and organizations[6,13,15].

Although these guidelines are well established, many studies still point to several gaps in processing, which can interfere with its effectiveness. Faults are identified from the beginning of the processing, still in the pre-cleaning stage. Authors pointed out that in some cases this step was not performed[29,39] or performed improperly, with the endoscopes disconnected from the light source[36].

Given its contribution to the removal of organic matter, preventing its drying out and adhering to the channels of the endoscope, which can make cleaning difficult later, before the equipment is removed from the light source and the video processor, water and detergent must be aspirated in all its channels. Thus, the guidelines establish that pre-cleaning should be performed at the point of use, immediately after the completion of each procedure[1,6,15].

The sealing test, which must precede cleaning (1.6), was the step most frequently ignored by professionals[29,32,36,40,41,43]. This failure in some cases can be attributed to the team's dissatisfaction in having to carry out this step[40], or even it is a reflection of the lack of knowledge of some professionals about the need for its accomplishment[33].

This gap can endanger safety when using endoscopes. Its function is to detect ruptures in the external and internal surfaces of the equipment that, when present, allow the infiltration of blood, fecal matter, secretions, cleaning solutions or disinfectants that can cause damage to its functioning, ineffective disinfection, in addition to contamination to the next patient[11,13,16]. Thus, its performance before cleaning is of paramount importance so that damage is detected and the equipment sent for repair[1,6,14].

Although the absence of the sealing test was more frequent, the greatest number of weaknesses found was in the manual cleaning step[20,28,29,35-37,40-42]. This is probably due to the innumerable steps inherent to this step, which requires a lot of care on the part of professionals, who often do not pay attention to such importance. It is worth mentioning that the effectiveness of this phase demands special attention both for the external part of the equipment and for the internal part, however, non-conformities such as not removing all the valves to perform the cleaning, in addition to not performing external friction of the endoscopes were found[41].

Despite the cleanliness of the channels being the most complex point, which demands greater dedication from professionals, important gaps were identified. Among them, brushing all channels, which, although essential, was considered absent in some studies[28,40,42]. In addition, it was identified that these channels were not filled with detergent before brushing[28,41], and this solution is mandatory and essential to facilitate the removal of dirt in the endoscopes[5,13-15]. In addition, there were inadequacies in the tools used to clean

Figure 2. Frequency of gaps found in the evaluated articles, according to stages of endoscopic processing (n=18). Belo Horizonte, MG, Brazil, 2020.

the equipment, such as the use of a single-diameter brush for all channels of the endoscopes[35]. It is known that the lack of reach of the bristles across the lumen can contribute to the accumulation of residues gradually[45] and consequently can promote the cross-transmission of microorganisms between patients[20,35,36].

Thus, as in cleaning, the disinfection stage also presented a considerable number of gaps, among the studies analyzed[32-34,36,41,43]. It is worth noting that this phase consists of the physical or chemical process that destroys most microorganisms, including mycobacteria and fungi, except for a high number of bacterial spores[46]. For disinfection to be effective, several aspects must be considered, such as the compatibility of the disinfecting agent with the equipment, the routine of checking its concentration and the correct contact time with the endoscope[1].

Contrary to scientific recommendations, some studies have highlighted gaps such as: time of immersion of the endoscope in the disinfectant solution lower than that recommended by the manufacturer[36,41], partial immersion of the endoscope in the disinfectant solution[36], as well as the non-use of this product to fill the channels[36,41], absence of monitoring of its

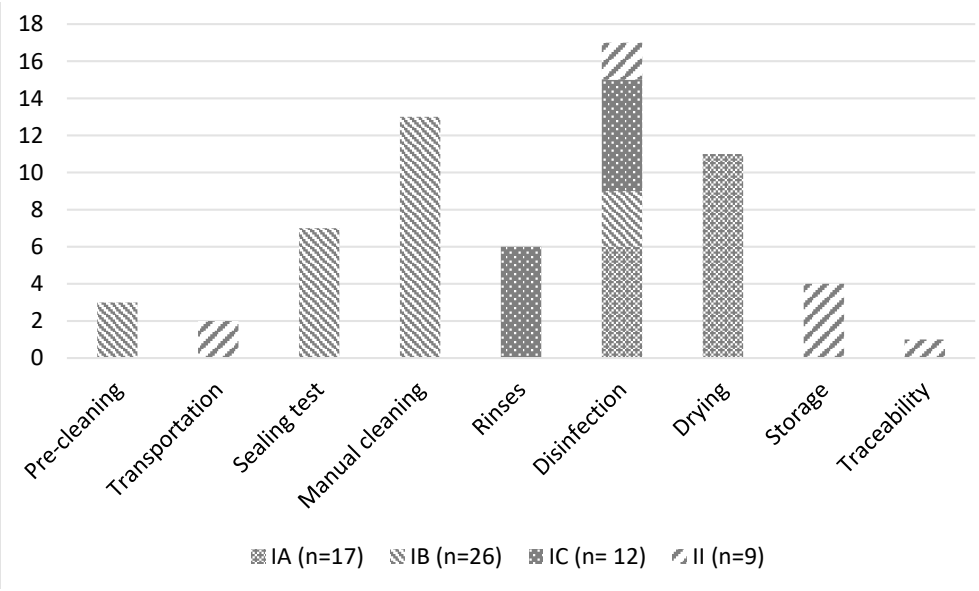

Figure 3. Frequency of the gaps found in the analyzed articles, according to the processing stage, in view of the international recommendations for endoscopic processing and their respective levels of evidence (n=64). Belo Horizonte, MG, Brazil, 2020.

minimum effective concentration (MEC)[34,41,43], in addition to disinfectant in concentration lower than recommended by the manufacturer[41] and lack of knowledge of the correct contact time of the equipment with this solution[33].

The absence of daily monitoring of the minimum effective concentration of the disinfectant contributes to risks of inadequate dilution of the product due to its frequent reuse, which can influence its effectiveness. In this sense, if the minimum concentration is not obtained, the solution must be discarded immediately, regardless of its dilution time or expiration date, which did not occur in the studies analyzed. In addition to these factors mentioned, for an effective disinfection, it is essential to ensure that the endoscope is fully submerged in the disinfectant solution, so that all its surfaces and channels are in contact with the product, according to the time recommended by the manufacturer[1,6,13,15].

Failures in the drying step were also frequently mentioned between the gaps, deserving special attention by the professionals responsible for endoscopic processing[27-29,35,40-42]. Incomplete drying of the endoscope between rinsing and disinfection[28,29,41] and before storage[32,35,39,42] were the most reported gaps, which reinforces the need for better service organization and periodic training for employees[29,33,36]. Such notes corroborate the results of Ofstead et al.[27] who detected moisture in all endoscopes evaluated in different services in the United States, with microbial growth in 71% of the equipment.

Considering that the residual moisture in the channels of the endoscopes becomes a conducive medium for the growth of microorganisms, complementary methods to drying need to be adopted to promote its elimination. Thus, in the storage step, an important point that contributes to the elimination of residual moisture from the endoscopes is the position in which the equipment is stored. The recommendation is that the equipment be stored in an upright position, as gravity facilitates the elimination of water residues that have remained in the equipment after drying[13-15]. However, with regard to the storage step, some studies have pointed to the inadequate packaging of this equipment, in a horizontal position[32,34]. Other critical points that deserve attention were the absence of a routine for cleaning and disinfecting the cabinets in which the devices are stored[43], in addition to the presence of dirt on the inside, increasing the risks of recontamination of this equipment[27].

In view of the studies analyzed, it appears that the effectiveness of endoscopic processing depends on the careful completion of several steps The violation of any of these steps compromises the effectiveness of the entire process and increases the risk of contamination among patients[31,32,35,37,42]. Therefore, considering that these gaps can occur routinely in clinical practice, it is necessary to reflect on the importance of implementing a surveillance process in endoscopy services, which would involve both the processing of endoscopes and the monitoring of patients after the procedure.

Such a routine would probably contribute to the risk assessment and, consequently, to the construction of quality and safety indicators, which could in fact impact on the improvement of practices, which are often perceived and

Chart 1. Characterization of the studies regarding the type of equipment and gaps identified (n=18). Belo Horizonte, MG, Brazil, 2020.

Author/Year	Type of equipment	Gaps identified in endoscopic processing	Outcomes
Bourigault et al., 2018[20].	Duodenoscope.	- Absence of brushing of all faces of the elevator channel.	Five patients colonized by Enterobacter OXA-48, with no death records. Processing failure may have been the cause of the transmission.
Ofstead et al., 2018[27].	Colonoscopes, gastroscopes, duodenoscopes.	- Automated processor filter with visible dirt and mold. - Pressure of forced air during manual drying below the limits specified by the manufacturer. - Inadequate drying of the endoscope before storage (15 to 20 seconds). - Storage of endoscopes in unventilated cabinets. - Internal structures of the cabinet with the presence of dirt.	- 71% of equipment with microbial growth. - 22% with high ATP levels (>200 RLU).
Cristina et al., 2018[28].	Gastroscopes and duodenoscopes.	- Not filling the channels with detergent. - Absence of brushing of all channels. - Absence of rinsing after disinfection.	Only processing-related problems assessed without outcome investigation.
Kenters et al., 2018[29].	All types of flexible endoscopes, including gastrointestinal ones.	- Absence of pre-cleaning at the point of use. - Absence of sealing test. - Absence of drying of the endoscope before disinfection.	Only processing-related problems assessed without outcome investigation.
Ofstead et al., 2017[30].	Colonoscopes and gastroscopes.	- Insufficient drying in the automated processor.	- 60% of endoscopes with microbial growth.
Robertson et al., 2017[31].	Duodenoscope.	- Insufficient drying in the automated processor.	Infectious outbreak by *Salmonella enteritidis* involving 4 patients, with no death records. Processing failure was identified as the cause of the outbreak.
Yetkin et al., 2017[32].	Duodenoscope.	- Absence of sealing test. - Absence of microorganism retention filter in the automated processor (AER). - Failure to flush alcohol in the channels of the endoscopes before storage. - Drying the endoscope in room air without the aid of any device. - Endoscope stored in improper position (horizontal). - Endoscope not stored in cabinets, without any protection to the external environment.	Infectious outbreak by multiresistant *Pseudomonas aeruginosa*, involving eight patients. Of these, three patients died. However, mortality was apparently not directly related to infection associated with ERCP, as patients already had underlying disease, such as severe cardiac pathology. Processing failures, and especially contamination of the automated processor, may be associated with the outbreak.

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Chart 1. Continuation.

Author/Year	Type of equipment	Gaps identified in endoscopic processing	Outcomes
El-sokkary et al., 2017[33].	Gastrointestinal endoscopes.	- Lack of knowledge about the obligation to perform a sealing test before cleaning. - Lack of knowledge about the contact time of the endoscope with the disinfectant. - Lack of knowledge about the storage of valves and accessories disconnected from the endoscope.	- Equipment with microbial growth. - High protein levels (>6.4 µg/mL).
Costa, 2015[34].	Gastrointestinal endoscopes.	- Absence of monitoring of the disinfectant solution. - Endoscopes stored in improper position (horizontal).	Only processing-related problems assessed without outcome investigation.
Bajolet et al., 2013[35].	Gastroscope.	- Use of a single-diameter brush for rubbing all channels of gastroscopes. - Drying of the endoscope incomplete before storage. - Absence of exclusive cabinet for storing endoscopes. - Endoscope stored in improper position (horizontal).	Infectious outbreak by multiresistant ***Pseudomonas aeruginosa*** involving four patients. Of these, three died due to gastrointestinal bleeding, and infection was not the cause.
Ribeiro et al., 2013[36].	Colonoscopes and gastroscopes.	- Pre-cleaning performed with the endoscopes disconnected from the light source. - Absence of endoscope sealing test before cleaning. - Time of immersion of the endoscope in the detergent does not meet the recommended by the manufacturer. - No use of adapters to fill the channels with cleaning solution and disinfectant. - Partial immersion of the endoscopes in the disinfectant solution.	- 84.6% of colonoscopes and 80.6% of gastroscopes with microbial growth.
Alrabaa et al., 2013[37].	Duodenoscope.	Absence of brushing of the elevator channel.	Infectious outbreak by carbapenemase-producing *Klebsiella pneumoniae* (KPC), involving seven patients, in which one case culminated in death. The outbreak was related to inadequate cleaning of the elevator channel.
Zhang et al., 2011[38].	Gastrointestinal endoscopes.	- Time of immersion of the endoscope in the disinfectant does not meet the recommended by the manufacturer. - Absence of a traceability process.	Only processing-related problems assessed without outcome investigation.
Soares et al., 2011[39].	Gastrointestinal endoscopes.	- Absence of pre-cleaning at the point of use. - Failure to pack the endoscope in a suitable container when transported from one room to another. - Absence of rinsing of the canals after cleaning and after disinfection. - Endoscope not subjected to drying before storage. - Storage of endoscopes in boxes.	Only processing-related problems assessed without outcome investigation.

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Chart 1. Continuation.

Author/Year	Type of equipment	Gaps identified in endoscopic processing	Outcomes
Ofstead et al., 2010[40].	Gastrointestinal endoscopes.	- Absence of sealing test. - Absence of brushing of all channels and accessories. - Do not use compressed air to dry the endoscope.	Only processing-related problems assessed without outcome investigation.
Barbosa et al., 2010[41].	Gastroscopes.	- Failure to remove all valves to perform cleaning. - Partial immersion of the endoscopes in the detergent. - Failure to perform external friction of the endoscope. - Absence of brushing of all channels. - The recommended time for immersing the endoscope in the enzymatic detergent has not been followed. - Absence of sealing test. - Failure to fill the channels with detergent solution. - Absence of external and internal rinsing after cleaning and disinfection. - Time of immersion of the endoscope in the disinfectant solution does not meet the recommended by the manufacturer. - Absence of monitoring of the concentration of disinfectant solution. - Use of the disinfectant in a concentration lower than that recommended by the manufacturer. - Failure to fill the channels with disinfectant solution. - Absence of drying before and after disinfection. - Failure to pack the endoscope in a suitable container when transported from one room to another.	Only processing-related problems assessed without outcome investigation.
Aumeran et al., 2010[42].	Duodenoscopes.	- Brushing the channels before filling with detergent. - Incomplete drying of the endoscope before storage.	Infectious outbreak by extended-spectrum beta-lactamase-producing *Klebsiella pneumoniae* (ESBL), involving 16 patients, with no death records. Insufficient drying before storage favored the growth of residual bacteria.
Spinzi et al., 2008[43].	Gastrointestinal endoscopes.	- Failure to perform an endoscope sealing test before cleaning. - Absence of monitoring of the minimum effective concentration of the disinfectant solution. - Absence of cleaning and disinfection of endoscope storage cabinets.	Only processing-related problems assessed without outcome investigation.

highlighted as relevant only when major adverse events such as outbreaks and deaths are recorded.

Considering that most patients undergoing endoscopic procedures are mostly external, not hospitalized, and adverse events related to processing can manifest themselves in the long term, the lack of this standardization of surveillance implies that the relationship between the adverse event and the procedure is not identified, which possibly contributes to the risk of infection being underestimated, thus trivializing the fundamental care in the processing of endoscopes.

Although the results point to important gaps in all steps of endoscopic processing, it is worth mentioning that the integrative review may have limitations, both in terms of the potential heterogeneity of the selected studies, or in relation to their design and, therefore, the method of data collection may be distinguished in these designs. However, seeking to circumvent such a potential limitation in the data collection process, the rigor in the analysis of the characteristics, the method, the sample and the results, certainly made it possible to compare the selected articles as conducted in the present study. Furthermore, it allows us to infer that the gaps identified here may be wider than those presented here, deserving special attention for this gap, especially with regard to the daily practice of nursing in endoscopy services.

CONCLUSION

From this review, it was found that several critical issues in the processing of endoscopes are still present in clinical practice at all stages of the process. It is noteworthy that the most frequent gaps involved sealing test, manual cleaning, disinfection, drying and storage. Such findings point to an important gap in the practice of nursing in the processing of endoscopes that deserves further investigation. In addition, added to the absence of a standardized monitoring of process indicators of this practice, make it essential to promote discussions with professionals in training, and in the daily routine of endoscopy services, emphasizing the importance of each stage of processing. It is essential to clarify that neglecting and/or underestimating some stage can be decisive to increase the risk of adverse, mild or even fatal events.

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