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Defects detected in Rigid Endoscopes

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ABSTRACT

Surgical procedures using rigid endoscopes are well known for having advantages over conventional surgical procedures. However, these instruments are fragile and are subject to breakage. The objective of this study was to record and analyze the frequency and types of repairs required for different types of rigid endoscopes used in surgical procedures. As a result, it was possible to correlate the number of defects with the amount and types of procedures, incidences of repairs by types of optics, and types of defects by types of rigid endoscopes. According to the survey, smaller instruments are more subject to damage and need repairs.

Keywords – *Surgery Video; Defects in Rigid Endoscopes; Analyses and correlations.*

INTRODUCTION

Minimally invasive surgical procedures have many advantages over conventional procedures.[1-3] The device used to enable the visualization of the site of the procedure by video surgery is called a rigid or optical endoscope. Different optical models are used in pediatric and adult surgeries with different sizes and thicknesses. The design of a rigid endoscope also has the technical characteristic of tip angulation that varies between 0° and approximately 135°.[3]

Rigid endoscopes are widely used in surgical procedures, particularly in hospitals. However, rigid endoscopes are fragile, so monitoring use at all stages of the instrument's workflow is essential. Due to this fragility, there is a high incidence of malfunctions and defects throughout the instrument's use. These defects leave the devices unusable and impact the surgical schedule. Also, when malfunctions are not diagnosed in the flow stages, problems may only be perceived at the time of surgery.

It is important to check if the optic lenses are cracked or scratched or the optical rod is dull. A blurry image may be the result of moisture entering the optical system. Given the reflected light view, the surfaces should appear smooth and bright.[3]

Because of the above, collecting data on the number of device defects in specific hospitals and their possible causes was considered necessary to help evaluate and minimize future failures. Therefore, the main objective of this work was to map the defects and understand the possible causes of failures of these devices used in the operating room of a private, non-profit 500-bed hospital in southern Brazil. More than 2,000 surgical procedures are performed monthly in this hospital, and more than 600 are watched by video.

METHODS

For the management of rigid endoscopes, all optics belonging to the organization were recorded by type (such as arthroscope, hysteroscope, laparoscope), size, composition and angulation, model, and brand. As a result, more than 50% of rigid endoscopes in the hospital's operating room were acquired after 2017 and had less than 5 years of use, as shown in Table 1.

TABLE 1. Rigid Endoscopes Acquisition Year

YEAR OF ACQUISITION	ENDOSCOPES
<2017	43%
2017	14%
2018	27%
2019	14%
2020	2%
TOTAL	100%

A form was developed and adopted to record the use of rigid endoscopes in the Surgical Center that could perform traceability of the flow of use of this device. When rigid endoscopes are returned to the Material and Sterilization Center, they are examined by a nursing professional to ensure that the device is returned in good condition. If it is found that the device is not fit for use after the cleaning procedures, it is sent to the clinical engineering team to do the initial technical analysis. The engineering clinic opens the service order, evaluates the device, and if it is impossible to perform the internal repair, it is sent to qualified technical assistance. When the rigid endoscope returns from repair, it is inspected, and the data and information are recorded in a checklist. Finally, the device is delivered to the material and sterilization plant if deemed fit for use. Work orders with the defect data of rigid endoscopes between 2017 and 2020 were then analyzed, and some of the results are shown below.

Findings

It was possible to observe that the relationship between procedures using rigid arthroscopy endoscopes is approximately 4 times lower than the number of procedures with hysteroscopy and laparoscopy. However, Figure 1 illustrates that arthroscopes have four times the repair density concerning the number of failures in hysteroscopy and laparoscopy endoscopes.

RESULTS

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density in relation to the number of failures in hysteroscopy and laparoscopy endoscopes.

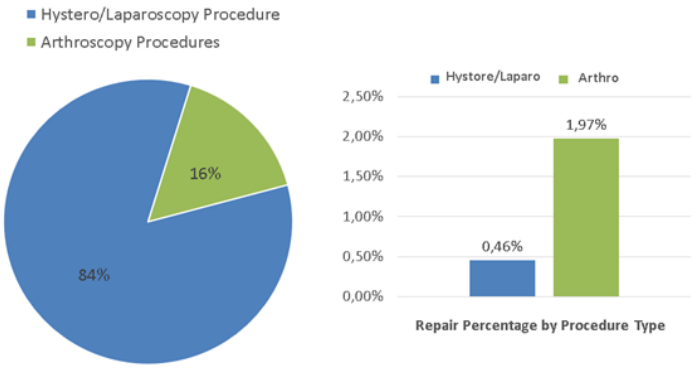

FIGURE 1. Relationship between types of procedures for video and breaks of rigid endoscopes.

Figure 2 illustrates the number of repairs required for the devices between 2017 and 2020. Arthroscopes are, first and foremost, the equipment that most needs repair over the years. Hysteroscopes vary widely in the total number of repairs required. This was especially notable between 2018 and 2019 when a 50% drop in the number of repairs occurred. By 2020, there was a very low total number of repairs on all types of endoscopes. Because many elective surgeries were canceled due to the COVID-19 pandemic.

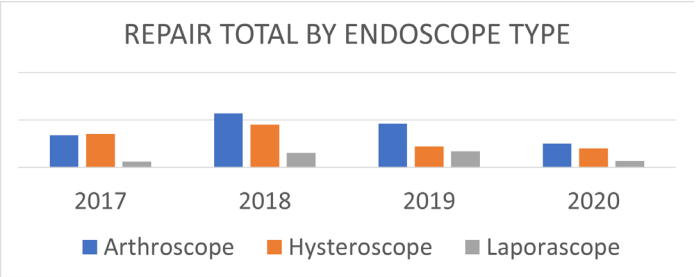

FIGURE 2. Relationship between maintenance by type of rigid endoscopes.

A survey of the main types of defects by optical types was also carried out. Figure 3 illustrates the incidence and types of defects in the different endoscopes. Hysteroscopes can be found to have a higher incidence of tube defects and broken internal lenses due to their manipulation during surgery. Arthroscopy optics, on the other hand, suffered more damage due to contacts with surgical motors, which damaged the distal window and the internal lenses.

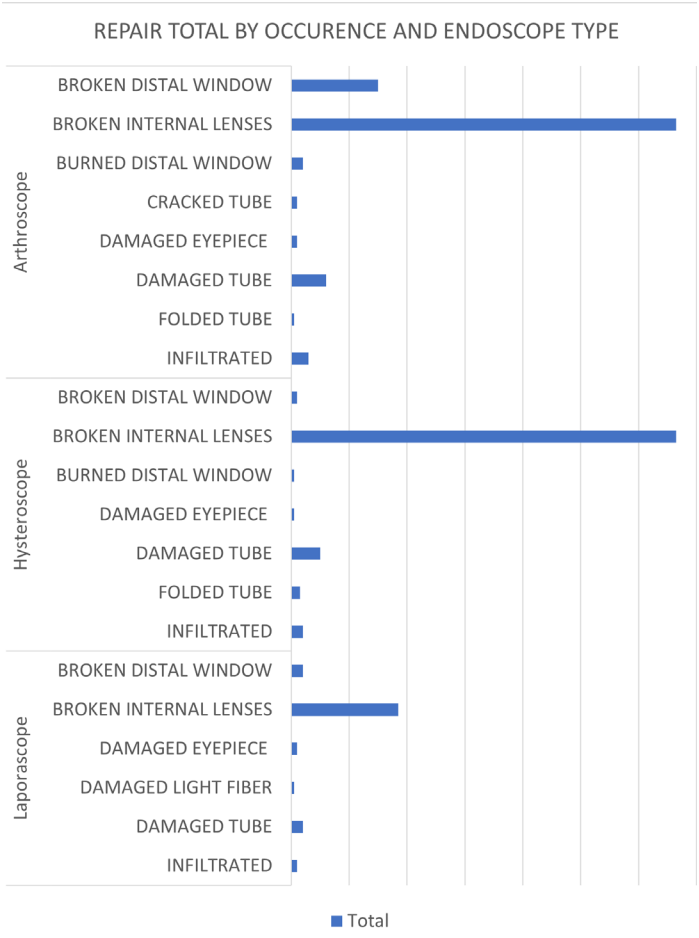

FIGURE 3. Types of occurrences by optical type.

As shown in Figure 3, arthroscopes have 8 types of defects. Hysteroscopes 7 and laparoscopes 6.

CONCLUSION

Paying attention to the entire operational flow of rigid endoscopes is imperative from purchase (acquisition of a good quality instrument), through the decontamination process and use, to the maintenance of instruments for video surgery. How they are sterilized, used, maintained, and inspected after repairs is the key to minimizing operational failure. A specialized team is required to supervise

the use of these instruments and evaluate their conditions at each stage of the workflow, to ensure a quick diagnosis the moment a malfunction occurs. The procedures for the development and qualification of professionals and companies providing maintenance services of these instruments are paramount, as they are decisive factors in the quality of repair and avoiding rework. With the study, it was possible to correlate the amount of defects with the amount and types of procedures, incidences of repairs by types of optics, and types of defects by types of rigid endoscopes. According to the survey, smaller instruments are more subject to damage and the need for repairs, as in the case of arthroscopes, which also presented the most diversity of defects.

It was also appropriate to share the statistics of failures, defects, downtimes, and costs with the users of these devices. And try collaboratively to think of actions to mitigate the damage. Since the costs of purchase are high, as well as the costs of maintaining and repairing these delicate instruments. In addition to impacting the agenda of surgical procedures. As these video procedures have been well disseminated for some time, the savings in acquisition, the proper use, and reduction of repairs can contribute to the control of the costs of medical-surgical procedures.

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