International Journal of Management Science Research, Vol.9, Issue 6, (Jun)
ISSN 2536-605X **2026**
DOI: 10.5281/zenodo.20542249

Analysis of Faults in the Use of Gastrointestinal Endoscopes

Jiyun Lu, Lijie Zhong*

The Second Affiliated Hospital of Wenzhou Medical University, Wenzhou 325000, Zhejiang, China
**Correspondence Author*

Abstract: ***This paper introduces the internal structure principle of the electronic endoscope. Through the statistics of 47 maintenance reports of a certain brand of electronic gastrointestinal endoscope in our hospital in 2021, the failure of the electronic gastrointestinal endoscope is classified and counted, and the reasons for the failure are analyzed. Propose corrective measures to reduce the failure rate.***

Keywords: GASTROintestinal endoscopy; FAUlt analysis; REDUCTIon of failure rate.

1. INTRODUCTION

From the earliest invention of the Koosmol tube by Kösmol in Germany in 1868, to the invention of the flexible gastroscope by Tatsuro Uji in Japan in 1950, and now to the widely used electronic gastrointestinal endoscopes, gastrointestinal endoscopes have undergone continuous upgrades and development. However, electronic gastrointestinal endoscopes have a high failure rate and expensive repair costs. Therefore, this article analyzes the causes of various common failures by classifying and statistically analyzing 47 repair reports of a certain brand of electronic gastrointestinal endoscopes from a top-tier hospital in 2021, and proposes corrective measures.

2. STRUCTURE AND PRINCIPLE OF GASTROINTESTINAL ELECTRONIC ENDOSCOPE

The main components of an electronic endoscope are: a light guide insertion section, an operating section, and an insertion section, as shown in Figure 1. The insertion section enters the body, providing real-time image observation and a treatment channel. The insertion section is further divided into an insertion tube and a curved tube; the CCD, nozzle, and forceps tube openings mentioned in the following troubleshooting analysis are all located at the very tip of the curved tube. The main function of the operating section is to adjust the angle, control the image, and control the air and water supply; therefore, the operating section is essentially composed of knobs and buttons. The light guide insertion section is connected to the endoscope main unit and the light source, transmitting electrical signals.

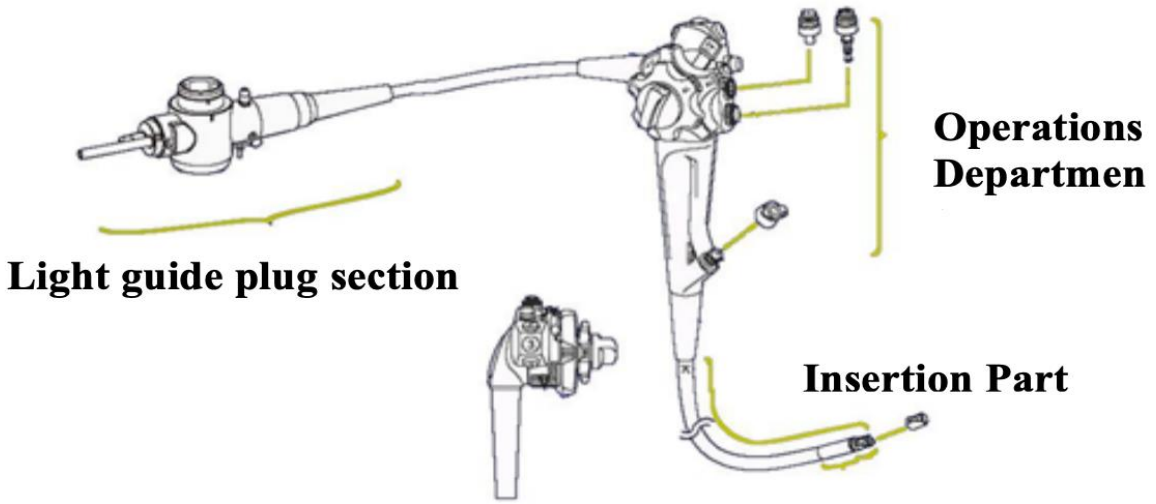

Figure 1: Structure of an electronic endoscope

3. FAULT STATISTICS AND ANALYSIS

3.1 Fault Statistics

The hospital has a total of 36 electronic gastrointestinal endoscopes of a certain brand, including 25 electronic gastroscopes, 8 electronic colonoscopes, and 3 electronic duodenoscopes. Maintenance records for these devices in 2021 were collected, totaling 57 items. Analysis of all maintenance records revealed the following malfunctions: ① Wrinkled insertion tubing ② Button malfunction ③ Wear or breakage of CCD glass ④ Deformation or leakage of bent rubber ⑤ Indentation in the insertion section ⑥ Leakage in the forceps channel ⑦ Broken or yellowed light guide ⑧ Clogged nozzle. The frequency of each type of malfunction is detailed in Figure 2.

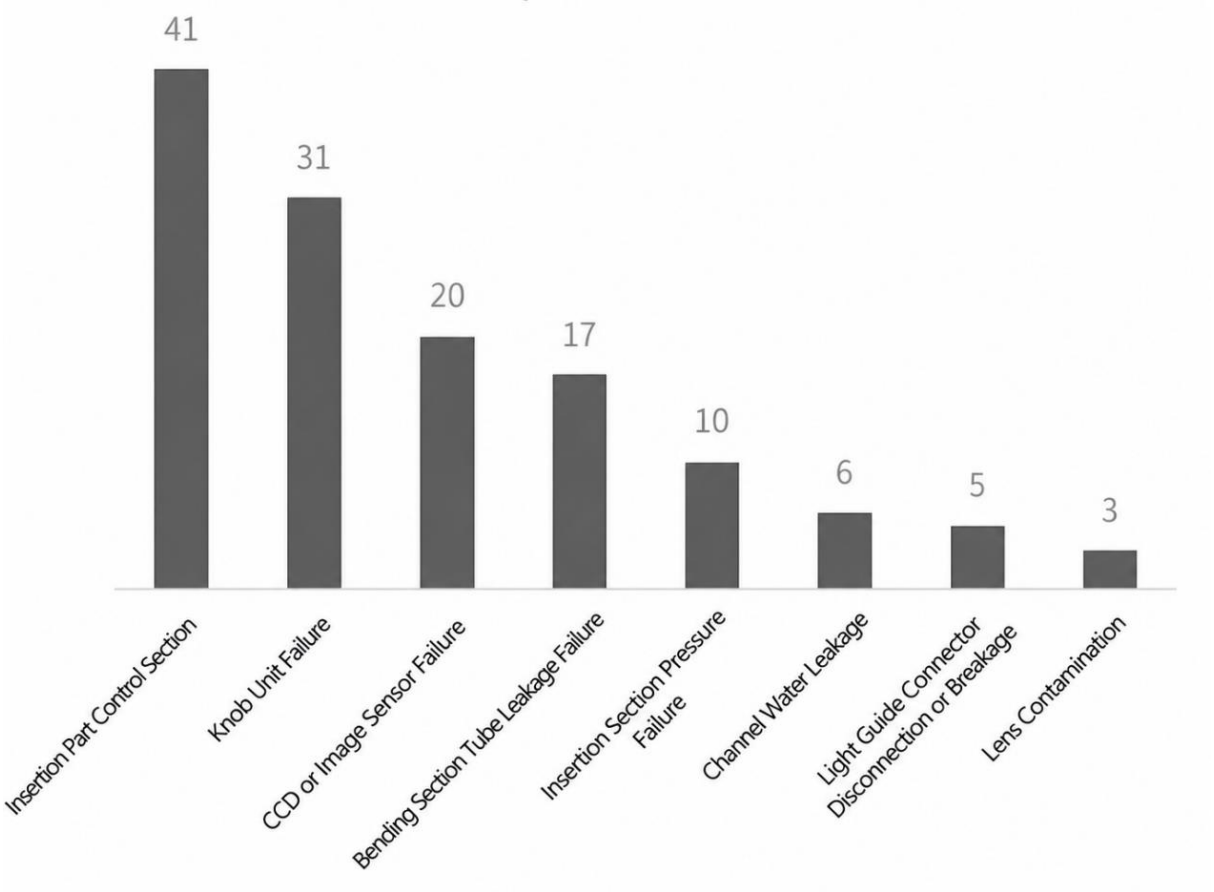

Figure 2: Statistics on the classification of malfunctions of a certain brand of electronic gastrointestinal endoscopes in this hospital in 2021.

3.2 Fault Analysis

3.2.1 Insertion tube folds

The most frequent component failure in this maintenance was the folding of the insertion tube. The causes of this failure are generally as follows: 1) The angle of the insertion tube coil is too small during cleaning, transportation, and storage; 2) Incorrect handling; 3) Excessive twisting during the inspection process; 4) The sheath is squeezed.

3.2.2 Button malfunction

Button malfunction was the second most common type of malfunction in this maintenance survey. The causes of this malfunction are generally as follows: 1) Improper operation by the operator; 2) Water leakage in the operating part often causes button malfunction; 3) The endoscope operating part overlaps with the light guide plug, and the metal parts of the light guide plug damage the button.

3.2.3 CCD glass wear or breakage

The CCD is the core component of the endoscope, located at the very tip of the gastroscope, and is a high-value, easily damaged part. The CCD glass protects both the objective lens and the CCD itself; wear or breakage will affect image display, commonly resulting in shadows and light spots. A broken glass cover also poses risks such as glass residue in the body and scratches to the patient's digestive tract. Common causes of this malfunction include: 1) Collision between the endoscope's insertion section and surrounding instruments during handling and transport; 2) Abrasion caused by contact between the tip and the cleaning tank during cleaning and disinfection; 3) Using inappropriate tools such as hard brushes to clean the endoscope surface; 4) Insufficient drying of the air/water supply pipes and the endoscope surface during storage.

3.2.4 The rubber may deform or leak when bent.

The flexible rubber insert is easily damaged due to tension and friction during use, accounting for a high percentage of repair failures in this survey. Common causes of flexible rubber insert failures include: 1) Damage to the insertion section from endoscope cases, storage cabinets, cleaning machines, etc.; 2) Injury caused by the patient biting the rubber; 3) Puncture from the outside by a sharp object; 4) Needles from injection or puncture needles piercing the rubber when released within the forceps tube; 5) Excessive force used when inserting or removing treatment accessories; 6) Excessive force used when cleaning the endoscope tip, causing the steel mesh assembly to detach or deform; 7) Scratches from sharp parts of the endoscope's light guide plug and accessories.

3.2.5 Indentation of the insertion part

In this statistical analysis, indentations appeared 10 times. This is usually caused by the insertion part being pinched by endoscope cases, storage cabinets, cleaning machines, etc., and is mostly caused by improper operation by the user.

3.2.6 Leaking water in the clamp channel

The forceps channel, also known as the treatment accessory channel, is a passageway that runs through the entire insertion section. Leaks in the tubing can cause rust on the bending wire, reduce the weld strength of internal components, increase resistance at the operating angle, cause welded parts to detach, and render the endoscope unusable. Common causes of this malfunction include: 1) The physician releasing needles such as injection needles or puncture needles into the forceps channel, causing sharp instruments to pierce the channel; 2) Using biopsy forceps with caps that cannot close, are misaligned, or have bent positioning needles; 3) Excessive force applied to the insertion section or pulling out treatment accessories; 4) Wear and tear on the forceps channel opening.

3.2.7 The beam guide is broken or yellowed.

A component that bundles multiple optical fibers together to guide light is called a beam guide. Its function is to transmit light emitted from a light source to the observed organ or part. Common causes of beam guide breakage or yellowing include: 1) Leaking water in the flexible light guide tube, which causes the beam guide to become damp, reducing its light-guiding performance; 2) Twisting, bending, or pulling of the flexible light guide tube can lead to beam guide breakage and reduced light-guiding performance.

3.2.8 Nozzle blockage

The nozzle, located at the tip, serves to rinse the endoscope and deliver air into the endoscope. It is prone to malfunctions such as deformation and clogging. The causes of these malfunctions generally include: 1) Impurities in the water used; the nozzle diameter is small, and it has angles, making it prone to clogging over prolonged use, especially at the angles; 2) Tissue, blood clots, and other substances can be drawn into the nozzle, causing clogging if not removed promptly; 3) Incomplete cleaning of the endoscope before disinfection; the disinfectant can cause protein coagulation, leading to clogging; 4) Improper wiping techniques, such as using cotton gauze, can cause the nozzle to become entangled, resulting in clogging.

4. CONCLUSION

This article analyzes the malfunctions of a certain brand of gastrointestinal endoscope in our hospital in 2021. It found that four types of malfunctions occurred most frequently, accounting for 81.95% of all malfunctions:

wrinkled insertion tubing, button malfunctions, CCD glass wear or breakage, and bent or deformed rubber or leakage. These malfunctions mostly occurred during transport and storage, cleaning and disinfection, use, and maintenance. These stages almost span the entire process of endoscope use, and significant improper use is evident. Although these may seem like minor operations, they can be fatal to this delicate instrument. Therefore, training for different personnel and at different stages, as well as routine inspections, are particularly important and areas we should focus on and improve in the future.

REFERENCES

[1] Du Jiang, Zhang Qiongying, Zhuo Yixuan, Yang Luokuan, Hu Bing, Huang Wenxia. Fault analysis of OLYMPUS GIF-H290 electronic gastroscope in Southwest China [J]. China Medical Equipment, 2021, 36(12):170-173.
[2] Gong hope, Zhu Yi. Faults and prevention of Olympus GIF-260 series electronic gastroscopes [J]. Medical Equipment, 2020, 33(13):106-107.
[3] Lu Jingfang, Wu Yuejiang, Sun Guiyue. Common faults and daily maintenance of electronic gastroscopes [J]. Medical Equipment, 2019, 32(22):149-150.
[4] Huang Xiaoping, Guo Zhanxiong. Discussion on management methods to reduce the failure rate and maintenance costs of gastrointestinal endoscopes [J]. China Medical Equipment, 2016, 31(11):172-173+179.