The Clinical Characteristics and Treatment of Mesh Infection After Laparoscopic Inguinal Hernia Repair

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Research

Keywords: Mesh infection, Laparoscopic, Inguinal hernia repair

Posted Date: October 16th, 2020

DOI: https://doi.org/10.21203/rs.3.rs-92154/v1

Abstract

Background: Mesh infection after inguinal hernia repair (MILIHR) is one of the rare and most serious complications. The aim of our study was to analyze the clinical characteristics and treatment methods of MILIHR.

Methods: Two MILIHR cases admitted to Beibei Traditional Chinese Medical Hospital were reported, and 32 MILIHR cases reported in Chinese and English literatures were retrieved. The clinical features and treatment of MILIHR in 34 cases were analyzed.

Results: In case 1, medical glue was found in in the infected area, and in case 2, the infection focal point was the residual hernia sac covering the pus. Risk factors of other cases included obesity, smoking, malignant tumor, diabetes, postoperative hematoma, postoperative aspiration of seroma, steroid or immunosuppressive drugs use, etc. The results of pathogen culture showed that there were 14 cases of Staphylococcus, 5 cases of Escherichia coli, 5 cases of Pseudomonas, 1 case of Hemolytic streptococcus, 2 cases of fungi, 2 cases of pseudoinfection (rejection). 33 cases were cured after the mesh was removed, and 1 case was cured after conservative treatment. The mesh was removed by laparoscopic surgery in 22 cases and by open surgery in 11 cases.

Conclusions: The risk factors of MILIHR are multifactorial and the using of medical glue and residual hernia sac may be the risk factors of mesh infection. The main pathogens of MILIHR were Staphylococcus, Escherichia coli and Pseudomonas. The most reliable way to treat MILIHR is to remove the mesh completely. The removal of the infected mesh by laparoscopic surgery can clearly identify the important anatomical structures and avoid anterior approach abdominal wall damage during re-hernia repair.

Background

Inguinal hernia is a common and frequent surgical disease. In China, according to epidemiological data, the incidence of inguinal hernia is about 1.7‰-3.6‰ [1-3], while the incidence of inguinal hernia in the elderly is as high as 11.3‰ [4]. It is roughly estimated that the annual number of adult inguinal hernia surgeries in China may reach 1.5 million [3]. With the wide application of polypropylene and other synthetic materials, the recurrence rate of hernia was significantly reduced [5]. However, infection, rejection, seroma, intestinal adhesion, intestinal obstruction and other complications caused by mesh have become new clinical problems [6,7]. According to statistics, the incidence of mesh infection after abdominal hernia repair was 1 ~ 4% [8], among which the mesh infection rate after inguinal hernia repair by open surgery was about 1.0% ~ 9.1% [9], while that of MILIHR was 0.7%-2% [10]. Although the infection rate of mesh is low, postoperative mesh infection is the most serious postoperative complication, and the clinical treatment is a difficult and thorny problem. In most cases, the key to treating mesh infection is to completely remove the mesh [11]. According to the existing literature, most of the reported treatment measures were mesh infection after traditional surgery. With the gradual

popularization and development of laparoscopic inguinal hernia repair, rare MILIHR reports appeared. The purpose of this study was to analyze the clinical characteristics, etiological characteristics and treatment of MILIHR .

Materials And Methods

Case reports

Case 1：a 25-year-old male with body mass index (BMI) of 23.2, was admitted to hospital for 41 days of recurrent pain in the right inguinal region after laparoscopic hernia repair. The patient underwent laparoscopic transperitoneal preperitoneal repair (TAPP) for the right inguinal hernia in September 2019. Intraoperative hernia sac was 3cm × 3cm × 4cm，and fully free and completely separated without bleeding. The right myopectineal orifice was repaired with 10.3cm×15.7cm Bard 3D Max Light Mesh and fixed with Kangpont medical glue(α-cyanoacrylate). No incision drainage tube was left. The patient was discharged 4 days after operation.

After discharge, the patient had repeated pain in the right groin area, no abdominal distension, abdominal pain, frequent urination, urgency and dysuria. The temperature was 36.2℃, and there was a 3.5cm×4.5cm hard mass in the right groin, tenderness, no bruising in the groin, and no swelling in the right scrotum. Blood routine examination showed white cell count of 10.98×10^9/L，C-reactive protein and procalcitonin showed no obvious abnormalities. Abdominal CT outside the hospital showed local effusion in the right inguinal area, abscess could not be excluded. Under the guidance of color ultrasound, local hydrops in the right groin were aspirated and 4ml milky white pus was extracted. The bacterial culture showed pseudomonas aeruginosa, which was treated with sensitive antibiotics for intravenous anti-infection, and under the guidance of color ultrasound, multiple punctures and suction drainage were performed for treatment.

The patient underwent laparoscopic exploration, mesh removal and abscess drainage after the failure of conservative treatment. Intraoperative exploration showed adhesion of large omentum with the right inguinal region, effusion and pus around the patch, and a medical glue about 0.6cm×1.0cm was found in in the infected area. The patch was exposed and separated, and the pus cavity was repeatedly rinsed. A silicone drainage tube was placed behind the pubis. The mesh and medical glue were removed completely, and the incision was closed to end the operation. Demonstration of MILIHR was illustrated in Fig. 1. After 6 months of follow-up, no pain and discomfort, no residual infection and no recurrence of hernia were found in the right inguinal area.

Case 2: a 76-year-old male with a BMI of 21.3 was admitted to the hospital because of "pain in the right groin for about 15 days and aggravation for 3 days". The patient underwent right inguinal oblique hernia in our hospital in June 2017 (32 months ago) through TAPP. During the operation, the right inguinal hernia sac was found to be 4cm×4cm×6cm. The hernia sac was transversely cut at the inner ring opening, and the distal end remained.

15 days before admission, the patient was scalded by the heater, and the waist was red, swollen and painful, accompanied by a blister formation, followed by chills and fever, up to 39.1 ℃. Blood routine examination showed white cell count of 12.61×10^9/L. After intravenous anti infection treatment, the burn wound healed gradually, but the patient had right groin pain, and physical examination showed that right groin area had local swelling with tenderness, no obvious fluctuation, and skin temperature is not high. Enhanced CT: right inguinal area mixed density mass, considering the possibility of abscess, and puncture found milky white pus, bacterial culture was Staphylococcus aureus.

After conservative treatment, the patient had poor efficacy, and underwent laparoscopic exploration, mesh removal and abscess drainage. Intraoperative exploration showed that there was no adhesion in the abdominal cavity, about 5ml white pus was found in the remaining hernia sac after the mesh was removed, and the abscess cavity was rinsed. A drainage tube was placed in the preperitoneal space, the mesh and the hernia sac were taken out, and the peritoneal incision was closed to complete the operation. Demonstration of MILIHR was illustrated in Fig. 2. The patient recovered smoothly after the operation, and up to now, no obvious discomfort and no recurrence of hernia were found in the patient.

Literature review

Through PubMed, Google Scholar, Wanfang, CNKI, VIP, SinoMed databases, the key words including Chinese and English "hernia/infection/laparoscopy, hernia/abscess/laparoscopy, mesh infection/laparoscopy, inguinal hernia,/infection/ transabdominal preperitoneal (TAPP), inguinal Hernia/infection/totally extraperitoneal (TEP) "("/" means “and”) retrieved 13 relevant Chinese and English literatures from 1998 to 2019, excluded duplicative cases, and obtained detailed information [12-24]. A total of 32 subjects were included in the study.

Results

A total of 34 MILIHR patients were enrolled in the study in combination with 2 cases of MILIHR patients admitted to our hospital. There were 27 cases of male, 7 cases of female, and male to female ratio is 3.86:1, and the age ranged from 21 to 78 years. The clinical manifestations of the inguinal region mainly local swelling and pain, lumps, sinus tract secretions, and some patients accompanied by fever. Blood examination showed that the white blood cells and inflammatory markers in most patients may be elevated. ultrasound or CT scan can display the mesh around empyemata or effusion. Risk factors of mesh infection: obesity (BMI >30) in 3 cases, smoking in 4 cases, malignant tumor in 1 case, steroid use in 2 cases, immunosuppressive use in 1 case of autoimmune disease, diabetes in 1 case, medical glue in 1 case, residual hernia sac in 1 case, postoperative hematoma in 2 cases, postoperative aspiration of seroma in 2 cases. Time from postoperative hernia to clinical signs and symptoms: 5 cases within 3 months, 20 cases from 3 months to 1 year, 9 cases after 1 year. According to the duration of infection, there were 4 cases of early infection <1 months, 7 cases of tardy infection ≥1 months, ≤3 months, and 7 cases of chronic infection > 3 months and 16 cases were not noted in the literature. There were 12 cases of bilateral laparoscopic inguinal hernia repair and 22 cases of unilateral inguinal hernia, and the surgical

methods included 25 cases of TAPP and 9 cases of TEP. Only one patient underwent emergency surgery due to incarceration of hernia, while the others were elective surgeries. All the patients underwent smooth surgery without massive hemorrhage or damage to the bladder, intestines, large blood vessels and other organs during the operation. As for the mesh material, 9 cases were polypropylene, 2 cases were polytetrafluoroethylene, and 2 cases were polyester. Among them, 21 cases were not marked with the mesh material. The clinical characteristics of specific patients are shown in Table 1.

Table 1 Baseline characteristics of the patients

Characteristics	Cases（34）	Percentage（%）
Gender	27	79.41
Male	7	20.59
Female		
Risk factors	3	8.82
BMI＞30	4	11.76
Smoking	2	5.89
Diabetes or Malignant tumor	3	8.82
Steroid or Immunosuppressive drugs use	1	2.94
Medical glue	1	2.94
Residual hernia sac	2	5.89
Postoperative hematomas	2	5.89
Aspiration of seroma	16	47.06
Unknown		
Time from postoperative to onset	5	14.71
<3 months	20	58.82
≥3 months，≤12 months	9	26.47
＞12 months		
Time from onset to cure	4	11.76
Early infection <1 months	7	20.59
Delayed infection ≥1 months, ≤3 months	7	20.59
Chronic infection > 3 months	16	47.06
Unknown		
Type of repair	9	
TEP	25	26.47
TAPP		73.53
Unilateral or bilateral hernia repair	22	**64.71**
Unilateral	12	35.29
Bilateral		
Type of mesh	9	**26.47**

Polypropylene	2	**5.89**
Polytetrafluoroethylene	2	**5.89**
Polyester	21	**61.75**
Unknown		
mesh removed	33	**97.06**
Yes	1	**2.94**
No		
mesh removal method	22	64.71
Laparoscopic mesh removal	11	32.35
Traditional open surgery		
Types of inflammatory reactions	32	94.11
Mesh Infection	2	5.89
Pseudoinfection (rejection)		

The results of pathogen culture showed that 27 cases were positive, 2 cases were aseptic growth, and 5 cases were not recorded. Among the culture positive cases, there were 15 cases of Gram-positive bacteria, including 14 cases of Staphylococcus and 1 case of Hemolytic streptococcus; 10 cases of Gram-negative bacteria, including 5 cases of Escherichia coli, 5 cases of Pseudomonas, and 2 cases of fungi: 1 case of Candida albicans and 1 case of Coccidioides. Combined with pathological examination, 2 cases of pseudoinfection (rejection) and 32 cases of mesh infection were identified, as shown in Table 2

Table 2 Results of pathogen culture

Pathogen	Cases（34）	Percentage（%）
G^+	14	41.18
Staphylococcus	1	2.94
Haemolytic streptococci		
G^-	5	14.71
Escherichia coli	5	14.71
Pseudomonas		
fungi	1	2.94
Candida albicans	1	2.94
Coccidioides		
Sterile	2	5.89
Unknown	5	14.71

In the early stage, 16 patients received conservative treatment such as anti-infection, irrigation, drainage and chronic sinus resection, but most of them had no curative effect. Only 1 patient with candida albicans infection recovered after antifungal treatment, irrigation and drainage, and the remaining patients with conservative treatment finally healed after the mesh was removed. Laparoscopic mesh removal was performed in 22 cases, and surgical mesh removal was performed in 11 cases. Partial patches were removed in 6 cases during surgical operation, and all the mesh were removed again or repeatedly due to persistent or recurrent infection. Two patients who underwent bilateral hernia repair underwent the second laparoscopic removal of the contralateral infected mesh and recovered. One patient was complicated with intestinal fistula, and the mesh removal and enterectomy were performed simultaneously.

Postoperative treatment with sensitive antibiotics was continued, the wound in the inguinal region was indwelling and draining, dressing was changed regularly, and all patients recovered smoothly. No obvious discomfort and complications occurred during postoperative follow-up. Most literatures do not mention the recurrence of hernia in patients with prognosis.

Discussion

Among the complications after hernia surgery, MILIHR is one of the most difficult to deal with, which presents a severe challenge to surgeons. At the same time, it will also cause a lot of mental and physical pain to the patients, and greatly increase the economic burden. Therefore, how to treat MILIHR and make

patients recover as soon as possible is worth more discussion. The factors leading to mesh infection are various, and the patient's own factors may increase the risk of mesh infection, including history of infection, obesity, smoking, malnutrition, incarcerated hernia, chronic obstructive pulmonary disease, diabetes, tumor, steroid use, poor cardiopulmonary function and low immune function [25-30]. In addition, other factors include unqualified instrument disinfection, long operation time, large foreign body implantation, fluid accumulation around the mesh or repeated suction of scrotal seroma, other contaminated operations, type of mesh are the risk factors for patch infection [31-34]. In this study, 43.24% of the patients had the risk factors reported above. In case 1, we found that there was medical glue in the infection foci, and in case 2, we found that the infection foci were the residual hernia sac surrounding pus. Therefore, we believed that the use of medical glue and the residual hernia sac could also become the risk factors for MILIHR.

Literatures reports the pore diameter of the mesh and the fiber structure may increase the rate of mesh infection. The anti-infection ability of the polypropylene mesh with single strand fiber structure (pore diameter > 75 μm) is better than that of the polytetrafluoroethylene mesh with multi strand fiber structure (pore diameter < 10 μm). Polypropylene mesh with large aperture, allow through the fiber mother cell. However, the polytetrafluoroethylene can only allow bacteria to mesh and phagocytes can't through the mesh. In this study, due to limited data, although the difference between mesh type and MILIHR cannot be explained, it is worth further study.

The diagnosis of MILIHR can be confirmed by medical history, imaging examination and bacterial biological culture. However, the clinical manifestations of mesh infection varied from local swelling, pain and mass in the inguinal region in the early time to chronic inflammatory sinus tract in the later period. Because of the depth of the patch infection after laparoscopic surgery, early diagnosis is not easy. Early symptoms of swelling, pain tends to be considered for surgical trauma, postoperative complications of chronic pain, even suspected of infection, the majority of patients also only application in early treatment, pain killer, antibiotics and other conservative treatment, this leads to the majority of patients do not have access to heal, illness gradually increase to the chronic course [35], so the majority of patients had longer duration of MILIHR. In this study, according to limited statistical data, 46.7% (7/15) of the patients had infection duration longer than 3 months.

The most common infection bacteria of mesh infection is Gram-positive Staphylococcus aureus, followed by gram-negative bacteria Escherichia coli [24.34.36].In this study, bacteria of MILIHR mainly followed by Staphylococcus (41.18%), Escherichia coli (14.71%), Pseudomonas (14.71%), similar to the literature, but also contains the mesh 2 cases caused by a fungus infection, in addition, there are 2 cases no bacterial growth, by combining with pathologic examination, they were diagnosed with rejection, considering of the infection. Although there was no bacterial infection, the clinical symptoms of pseudoinfection were the same as those of genuine infection, and the radical treatment was to remove the mesh.

The most reliable way to treat MILIHR is to remove the patch completely. Mesh infection through three steps including bacterial adhesion, proliferation and the formation of biofilm [25]mesh as a foreign body reduces the threshold of bacteria required for infection. The biofilm formed by bacterial adhesion to the patch can enhance the resistance of bacteria to antibiotics and evade host immune function, this layer of biofilm can form a protective barrier, hinder antibiotics through makes it difficult to treat infection, often antimicrobial treatment effect is not ideal [34].Therefore, the systemic application of antibiotics, local dressing change, incision irrigation, negative pressure drainage and other conservative treatments makes the treatment of mesh infection very difficult, and often increases the treatment time of patients. Only when the infected mesh is removed can the cure be achieved. Moreover, incomplete mesh removal can lead to multiple surgeries for the recurrence of infection [10,37,38]. In this study, only 1 case of fungal infection was cured by conservative treatment, and the remaining 33 cases were healed by taking out the mesh. Therefore, the most reliable method to treat MILIHR is to remove the patch timely and completely.

The choice of surgical treatment should maximize the benefits of the patients. Traditional surgery is a common method to remove the mesh, which is reached to the infection level through layer by layer of free tissue. However, laparoscopic hernia repair is performed by placing the mesh in the preperitoneal space through the posterior approach, which means that multiple layers of healthy tissue can be destroyed by open surgery before the infection can be reached [24]. In the study, the ratio of laparoscopy to traditional surgery was 2:1but we suggest that laparoscopic mesh removal should be selected. On the one hand, the amplification effect of laparoscopy is conducive to the complete removal of the mesh and the identification of important anatomical structures. On the other hand, it provides a simple and feasible anterior approach for reoperation of hernia recurrence after mesh removal.

Conclusions

MILIHR is one of the most difficult complex complications to treat. The risk factors of mesh infection are multifactorialincluding the using of medical glue and the residual hernia sac. Most of the patients had a long course of infection, and the main pathogens of MILIHR were Staphylococcus, Escherichia coli and Pseudomonas. The most reliable way to treat MILIHR is to remove the patch completely. The removal of the infected mesh by laparoscopic surgery can clearly identify the important anatomical structures and avoid anterior approach abdominal wall damage during re-hernia repair.

However, the long-term recurrence of inguinal hernia after mesh removal in this study needs to be further followed up and studied. Meanwhile, the number of cases in this study is small, and the advantages of laparoscopic treatment still need to be verified in large sample clinical practice. In addition, MILIHR control and treatment is a complex problem, and individualized treatment regimen should be formulated according to infection inducement, mesh type, surgical mode, hernia type and other factors, which need to be further explored by general surgeons.

Abbreviations

MILIHR: Mesh infection after inguinal hernia repair; BMI: Body mass index; TAPP: Transperitoneal preperitoneal; TEP: Totally extraperitoneal repair; CT: Computerized tomography.

Declarations

Ethics approval and consent to participate

The two cases report and study were approved and supervised by the ethics committee of Beibei Traditional Chinese Medical Hospital.

Consent for publication

Written informed consents for publication of patients' clinical details and clinical images were obtained from patients in the two cases.

Availability of data and materials

The datasets used during the current study are available from the corresponding author on reasonable request.

Competing interests

The authors declare that they have no competing interests.

Funding

There is no funding.

Authors' contributions

YL and CSW contributed to the conception and design, and YL wrote this article. All authors have read and approved the manuscript.

Acknowledgements

Not applicable.

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Figures

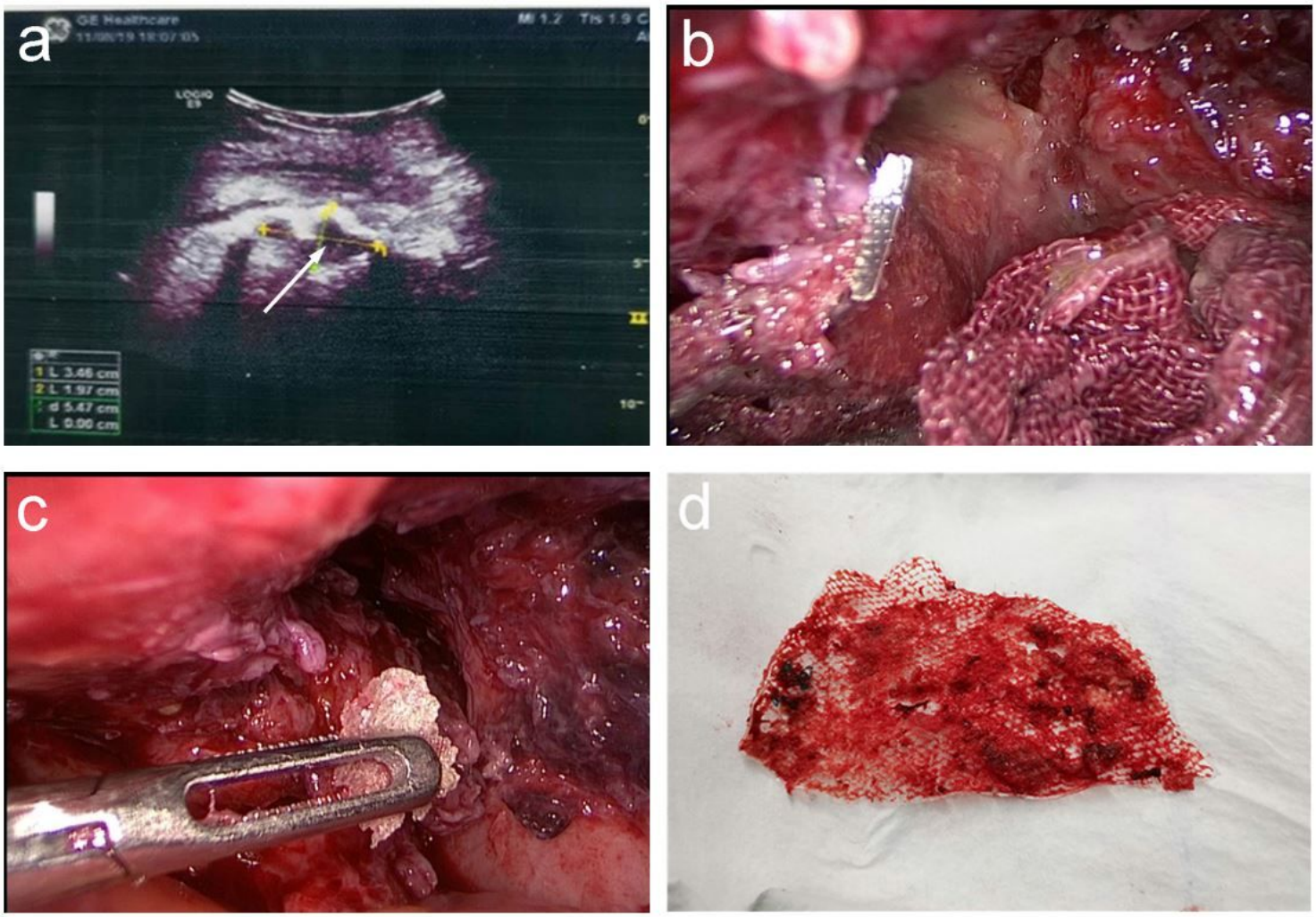

Figure 1

Demonstration of MILIHR in 1 case. a color ultrasound considered pus□b pus outflow□ c remove medical glue□d complete patch removed.

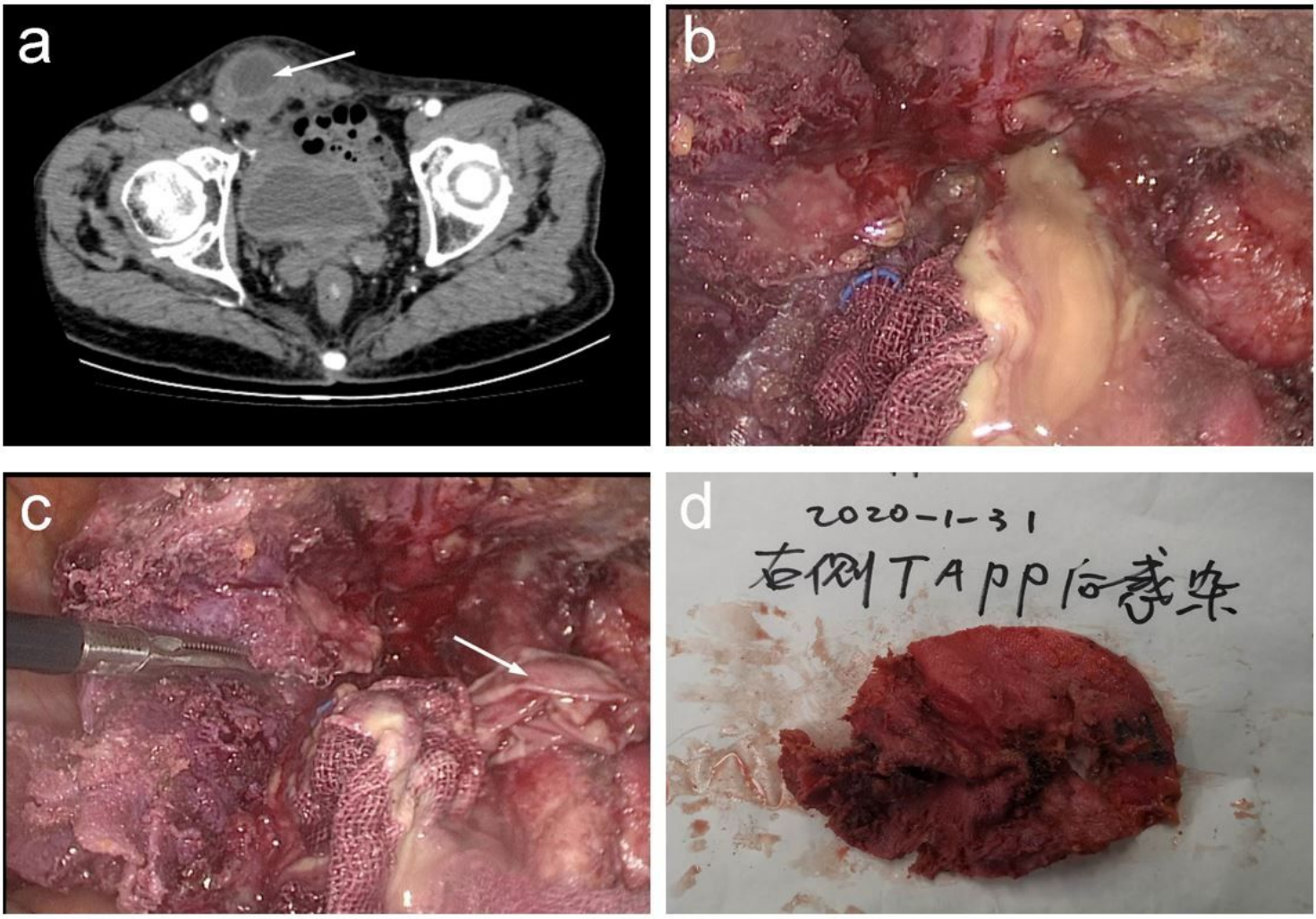

Figure 2

Demonstration of MILIHR in 2 case. a CT shows right inguinal abscess；b pus outflow；c residual infectious hernia sac；d complete patch removed.