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The Gupta-Akami technique for percutaneous drainage of superficial liver abscess: An indigeneous economic method for low resources setups

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ABSTRACT

Objective: Liver abscesses, which are purulent cavities within the liver, pose significant health challenges, particularly in developing countries where treatment resources are limited. Despite advancements in imaging and drainage technologies, conventional methods such as pigtail catheters and surgical interventions are often financially prohibitive and inaccessible in low-resource settings. This study proposes Gupta-Akami technique, an indigenous and economically viable method for percutaneous drainage, utilizes simple, readily available materials and offers a potential solution for these settings.

Material and Methods: The study was conducted at a tertiary care hospital over a period of six months. It included 21 patients with liver abscesses meeting specific criteria (abscess volume >500 mL, intervening liver parenchyma <5 cm, and skin-to-abscess distance <10 cm).

Results: The average age of the patients was 45.6 years and there were more men than women. Most patients presented with fever and abdominal pain; nausea/vomiting was observed in the majority, and jaundice was noted in a few. Mean abscess volume was 890 mL. The procedure effectively drained over 87% of the abscess volume and only one patient requiring additional aspiration. Post-procedural pain decreased significantly from an average of 3.15 on a visual analog scale at 0 hours to 0.84 before discharge. The average hospital stay was 2.57 days. No complications or mortality were reported.

Conclusion: The Gupta-Akami technique demonstrates efficacy as a low-cost, accessible method for percutaneous drainage of liver abscesses in resource-limited settings. It offers a promising alternative to more expensive traditional methods, potentially improving patient outcomes and accessibility in low-resource environments.

Keywords: Liver abscess, metallic trocar, Ryle's tube, catheter drainage, economical method

Video link: https://turkjsurg.com/video/UCD-6563-v1.mp4

INTRODUCTION

Liver abscess is a common infection of the liver and gastro-intestinal tract in India caused by a bacterial, parasitic, or fungal infection (1). Every year, approximately 40-50 million people worldwide become infected, with developing countries accounting for the vast majority of infections. In endemic areas, infection rates exceed 5-10%, and in some cases can reach 55% (2,3). The highest prevalence is found in developing tropical countries, particularly in Mexico, India, Central and South America, and tropical Asia and Africa. In fact, India is reported to have the second highest incidence of liver abscess in the world (1).

Approximately 75% of hepatic abscesses in developed nations are caused by pyrogenic abscesses. While amoebic liver abscess accounts for two-thirds of liver abscesses in developing countries (4,5).

The treatment of a liver abscess is decided by its size, the patient's presentation, and comorbidities. Medical treatment with intravenous or oral antibiotics is usually sufficient for small abscesses; however, for large volume abscesses and in cases of sepsis, abscess drainage is required. A liver abscess can be drained via laparotomy or laparoscopic drainage (6-9). Percutaneous needle aspiration (PNA) or percutaneous catheter drainage (PCD) under image guidance ultrasonography or computarized tomography (USG or CT) is now preferred over surgical drainage due to lower morbidity and mortality, as well as a shorter hospital stay and earlier work (10-12).

McFadzean et al. described the percutaneous drainage method for liver abscess in Hong Kong in 1953 (13). PCD can bridge the gap between non-invasive and

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surgical intervention with minimally invasive, image-guided drainage (14,15). However, traditional drainage methods such as surgical interventions or pigtail catheters are often unavailable or too costly in low-resource settings. The Gupta-Akami technique, developed by Dr. Shardool Vikram Gupta and Dr. Kewecho Akami, is a low-cost, indigenous alternative that makes use of readily available materials and simplifies procedure steps. The purpose of this study was to examine the viability and effects of applying the Gupta-Akami technique in healthcare settings with limited resources.

MATERIAL and METHODS

This study was done at a tertiary care hospital over a period of six months (from October 2023 to March 2024). Given that the method is new and in its early stages, the authors developed patient selection and method application criteria based on safety and reproducibility while keeping in mind the fundamentals of percutaneous drainage as described in the literature (16). If the following criteria were met, all consenting adults with a liver abscess and no clinical or radiological signs of rupture were included.

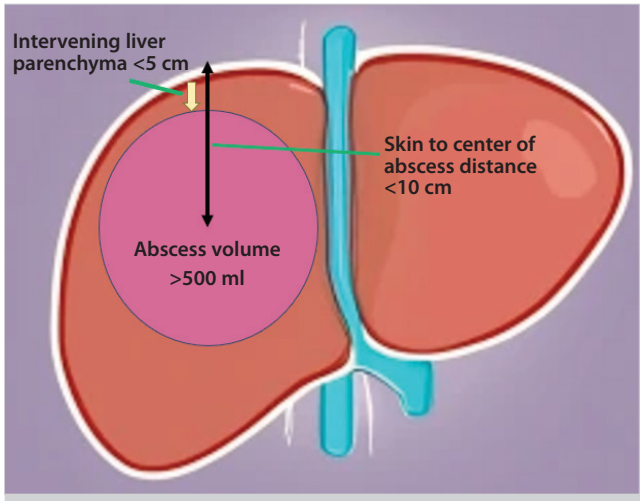

Figure 1. Pre-requisite characteristics of liver abscess kept for the technique.

The criteria of liver abscess were taken as: (Figure 1)

- Abscess volume> 500 mL
- Intervening liver parenchyma< 5 cm
- Skin to center abscess distance< 10 cm

Materials required for this technique are mentioned in the Table 1 and Figure 2 shows the material i.e. 5 mm laparoscopic trocar with ryles tube and pigtail also shown for comparison.

Surgical Technique

The patient is to be positioned supine. USG screening of liver abscess to assess the criteria set for procedure is done and then under USG guidance procedure is performed. The site for incision is marked and cleaned with betadine solution and draped to maintain sterility. 2% xylocaine, a local anesthetic, is infiltrated into the skin and deep up to the capsule of the liver to numb the area. A small incision of around 5 mm is made on the skin surface at the chosen site. The incision is dilated slightly using artery forceps to create a pathway for the trocar (Figures 3,4).

A 5 mm laparoscopic trocar is inserted percutaneously through the incision and guided into the abscess cavity under ultrasound guidance. A 10 cc syringe is attached to the trocar outlet, and fluid is aspirated to confirm that the trocar is indeed in the abscess cavity. The presence of fluid confirms correct placement. The obturator, which is the inner solid portion of the trocar, is then removed. A 14Fr Ryle's tube, a flexible tube used for drainage, is inserted through the trocar into the abscess cavity (Figure 5).

Once the Ryle's tube is in place, the trocar is carefully removed, leaving the Ryle's tube in position. The flow of pus through the Ryle's tube confirms that it is correctly positioned within the

Table 1. Materials and instruments required for the procedure

S.no.	Material Required	Rationale
1	5 mm laparoscopic trocar (metallic)	Multiple use; easy to sterilize
2	Injection xylocaine (1% or 2%)	For LA at site of incision
3	Surgical blade no. 11	For giving incision
4	Ryle's tube 14 Fr	Good caliber for drainage and can fit through the 5 mm port Easily available, low cost
5	2-0 silk suture	For fixing tube with skin
6	Drainage bag	For collecting pus
7	10 mL syringes	For giving LA, taking sample
8	Ultrasound machine	For evaluating abscess and guided drainage
9	Drape sheet, gauze pieces, betadine	For asepsis and dressing
10	Artery forceps	Dilating the incision site

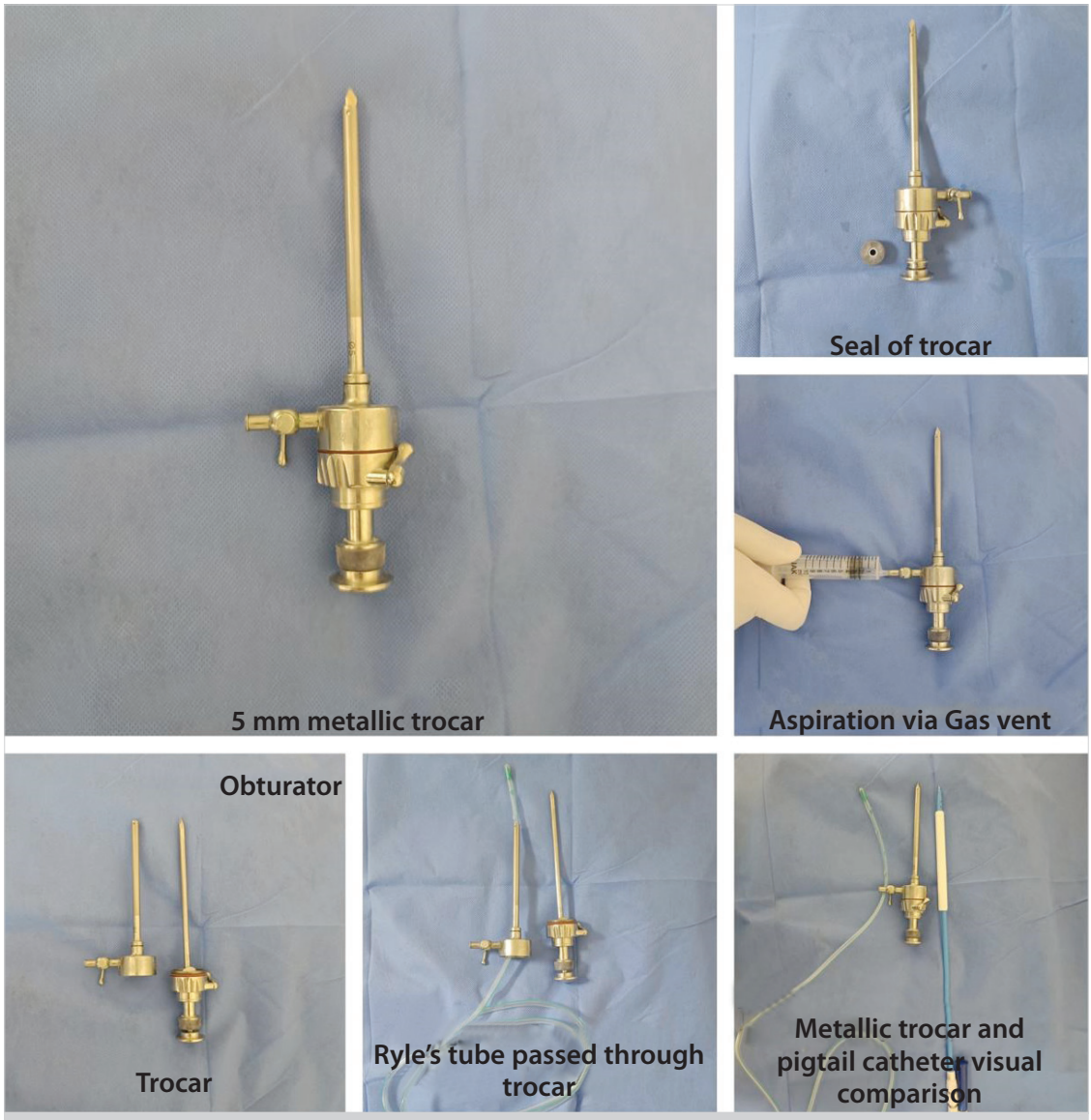

Figure 2. The laparoscopic metallic trocar and Ryle's tube required for insertion.

Figure 3. Ultrasound to assess the volume.

abscess cavity. This placement is also confirmed through ultrasound imaging. The Ryle's tube is then secured to the skin and adhesive dressing done to prevent movement and connected to a drainage bag or similar collection device to allow for gravity drainage of the pus (Figure 6).

During their hospital stay, the patients received intravenous broad-spectrum antibiotics as well as other supportive medications, and their vital signs and blood parameters were monitored. They were discharged after clinical symptoms were resolved or improved; sepsis was controlled, and the patient was allowed to start using oral medications. Follow up was done on out patient department basis for three months.

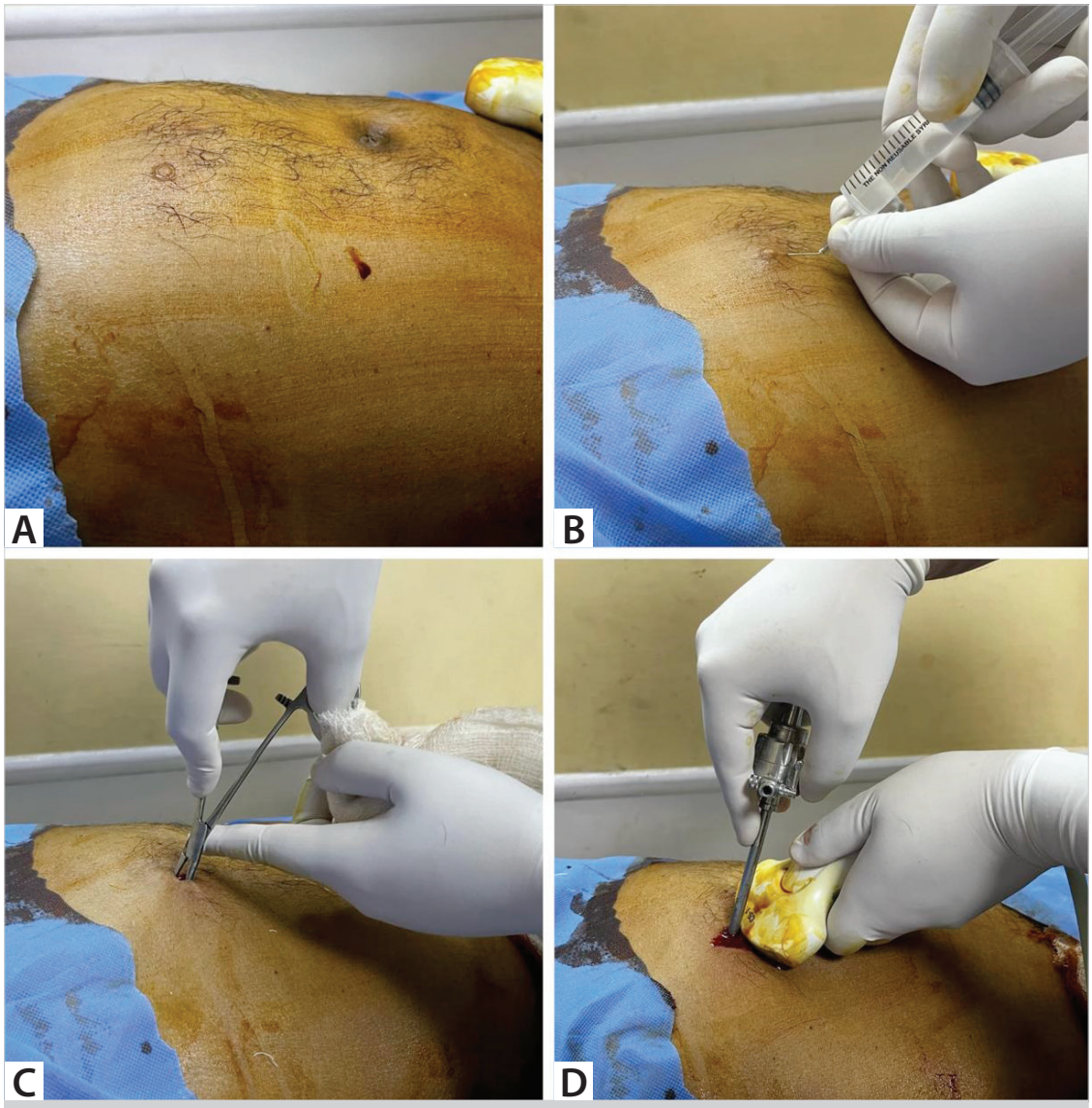

Figure 4. Steps for introduction of metallic trocar in liver abscess. **A.** Marking of incision site under USG guidance. **B.** 2% lignocaine, a local anesthetic, is infiltrated into the skin and deep to anesthetize the area. **C.** Small incision of around 5 mm is made on the skin surface and incision is dilated slightly using artery forceps to create a pathway for the trocar. **D.** Intoducing 5 mm metallic trocar under USG guidance.

RESULTS

During the study period, 79 patients were diagnosed with liver abscess, and 21 of them met the technique's pre-requisite criteria. Following informed consent, these 21 patients were included in the study, and their abscesses were drained using the Gupta-Akami technique. The study yielded the following results and observations.

The youngest patient in this study was 27 years old, and the oldest patient was 62 years old, with the study population having a mean age of 45.6 years. Most of the patients were between the ages of 40 and 50. There was a male sex preponderance of 18 patients versus three female patients. The clinical features observed in this study included fever, abdominal pain, nausea/vomiting, and jaundice. The most common symptoms were fever and abdominal pain, with only three patients showing jaundice. In the study population, 11 patients had no comorbidities, two had hepatitis B, and one had hepatitis C. Three patients had diabetes, two had hypertension, one had chronic kidney disease, and one had a history of coronary artery disease. In the study population, ten patients had a history of alcohol abuse and were chronic alcoholics.

According to the criteria established for our study, the procedure was performed on patients with a minimum abscess volume of 500 mL. The smallest liver abscess volume drained in this study

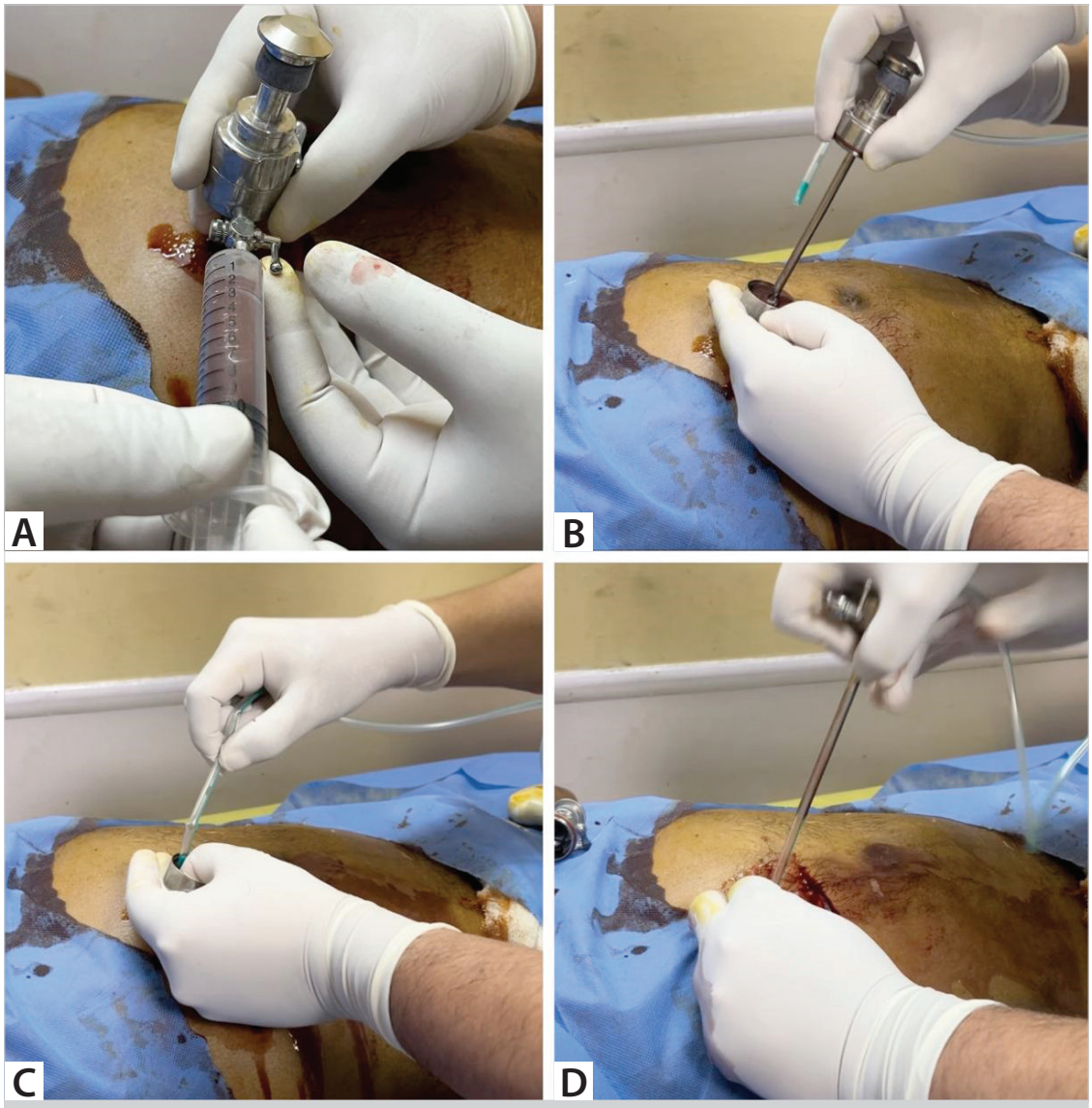

Figure 5. Steps for confirmation and inserting RT. **A.** Aspiration of pus through port to confirm entry inside abscess cavity. **B.** Removal of trocar from the port after entery into the abscess cavity. **C.** Passing the ryles tube through the trocar into abscess cavity. **D.** Removing the trocar after confirming the position of Ryle's tube in abscess cavity.

was 550 mL, while the largest abscess drained was 1.200 mL. The average liver abscess volume was 890 mL. The highest total leukocyte count (TLC) count observed in the study was 21.200/mL, while the lowest count was 8.300/mL. The average TLC count observed in the study was 12.706/mL.

On average, more than 87% of liver abscesses were drained after the drain was inserted, with only one patient requiring needle aspiration of pus later due to a separate cavity and non-resolution of symptoms. The study found no complications with the procedure, and there was no mortality.

Mean pain visual analog score after procedure at 0 hrs and 2 hrs was 3.15 (3-5) and after 24 hrs of procedure was 1.28 (1-3) and on before discharge of the patient was 0.84 (0-2). The average hospital stay was 2.57 days, with the longest stay being five days for one patient and the shortest being one day for one patient. Mean duration in reduction 50% cavity size in the study was 3.8 days (2-8 days).

DISCUSSION

Liver abscesses carry a high risk of sepsis and other serious health complications, potentially leading to high morbidity and mortality rates in patients. Patients with abscesses may become critically ill as a result of complications such as rupture into adjacent organs if not treated promptly. Radiologically guided interventions, such as percutaneous catheter drainage or percutaneous needle aspiration (PNA), in conjunction with antibiotic therapy, have proven to be highly effective in the

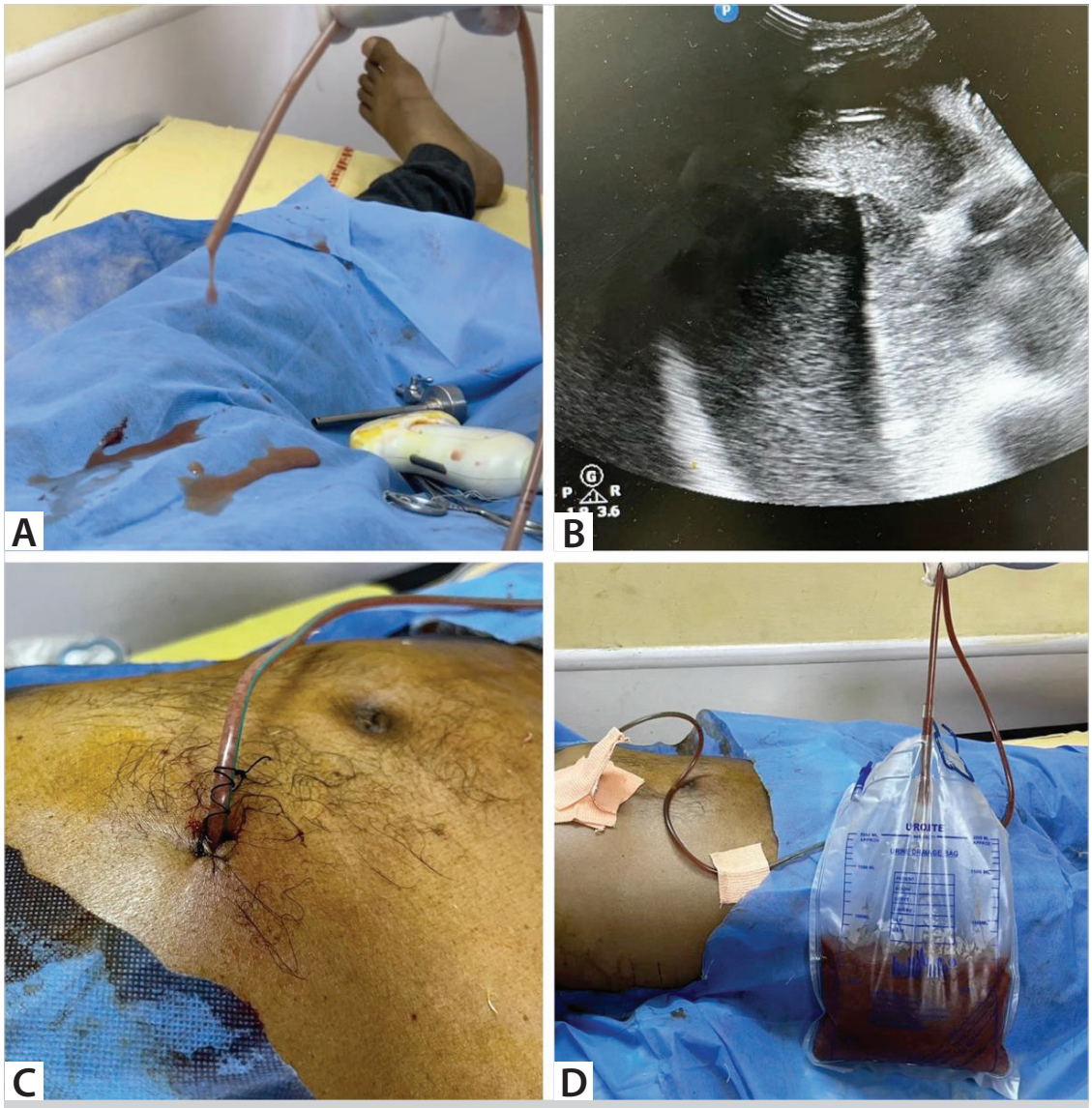

Figure 6. Confirmation and fixation of RT. **A.** Flow of pus through the Ryle's tube confirmed. **B.** Ryle's tube placement is also confirmed through ultrasound imaging. **C.** Fixation of Ryle's tube with skin. **D.** Pus drained via Ryle's tube after fixation.

treatment of liver abscesses, lowering morbidity and mortality rates (14,15,17). This approach has largely replaced surgical exploration, which is now used in very specific cases such as a ruptured liver abscess with peritonitis features.

The PCD has been preferred over the PNA due to the earlier resolution of the pus cavity and the fewer attempts required for proper pus drainage. The limiting factor for PCD is its availability and cost, particularly in settings catering to low-income populations with limited resources, which can sometimes force clinicians to resort to PNA or surgical methods due to the lack of commonly used pigtail catheters. This method has been developed to overcome this limiting factor because the materials used in our method, such as Ryle's tube, are relatively inexpensive and widely available in all wards, while the cost of a 5 mm trocar is significantly reduced due to its repeated use after sterilization.

As the principles of drainage are same i.e. putting a catheter or drain tube inside the abscess cavity to felicitate the drainage of pus, our method can be used in the setups where patients cannot afford to buy the pigtail catheters due to its cost or availability issues.

In this study involving 21 patients who met the criteria, we used our method for drainage of liver abscess and the results were at par with traditional PCD in terms of attempts required to drain the pus, hospital stay and complications. Additionally, it is common for small pigtail catheters to become blocked due to thick, viscous pus, requiring periodic flushing with

saline solution. However, this issue was not encountered in our case when using a 14Fr Ryle's tube.

We noted the time for 50% sonographic resolution of abscess cavities and that was also in concordance with the literature, which is around 3-9 days (18). The time required for complete sonographic resolution of abscess cavities following percutaneous treatment can vary widely, ranging from two weeks to nine months (19,20). However, total resolution may not always occur, and small residual cavities may persist for years, often resembling simple hepatic cysts (21).

The criteria which were set for this study for patient selection can be refined further by keeping the basic drainage principle in mind in studies with larger patient population.

The Gupta Akami technique holds promises as an economically acceptable alternative for percutaneous drainage of liver abscesses, especially in resource-limited settings. Its cost effectiveness, coupled with patient satisfaction and acceptability, underscores its potential to improve access to essential healthcare services and enhance the treatment outcomes for marginalized populations. However, further research is warranted to validate these findings and explore potential factors influencing patient preferences and healthcare utilization patterns.

CONCLUSION

Image-guided percutaneous drainage is extremely beneficial to critically ill patients, allowing for successful abscess drainage and sepsis control even when surgery is not an option due to deteriorating health. Our experience and research indicate that the Gupta-Akami technique has good economic viability and high patient satisfaction because it uses readily available materials and simplified procedural steps. Its affordability and acceptability can make it a viable option, especially for the economically disadvantaged. Continued research and application of this technique has the potential to reduce financial burdens and improve healthcare access for vulnerable populations.

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Ethics Committee Approval: The study was approved by the Atal Bihari Vajpayee Institute of Medical Sciences Ethics Committee (Decision no: TP (MD/MS) 31/2022 IEC/ABVIMS/RMLH, Date: 14.03.2023).

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Conflict of Interest: The authors have no conflicts of interest to declare.

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ORİJİNAL ÇALIŞMA-ÖZET
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Yüzeysel karaciğer apsesinin perkütan drenajı için Gupta-Akami tekniği: Düşük mali kaynaklı kurulumlar için yerli ekonomik bir yöntem

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ÖZET

Giriş ve Amaç: Karaciğer apseleri, özellikle tedavi kaynaklarının sınırlı olduğu gelişmekte olan ülkelerde önemli sağlık sorunlarına yol açmaktadır. Görüntüleme ve drenaj teknolojilerindeki ilerlemelere rağmen, pigtail kateterler ve cerrahi müdahaleler gibi geleneksel yöntemler genellikle mali kaynakları kısıtlı kurumlarda kolay ulaşılabilir değildir. Bu çalışma, perkütan drenaj için yerel ve ekonomik olarak uygulanabilir bir yöntem olan Gupta-Akami tekniğini önermekte, basit, hazır malzemeler kullanmakta ve bu ortamlar için potansiyel bir çözüm sunmaktadır.

Gereç ve Yöntem: Çalışma üçüncü basamak bir hastanede altı aylık bir süre boyunca yürütülmüştür. Belirli kriterleri (apse hacmi >500 mL, araya giren karaciğer parankimi <5 cm ve cilt-apse mesafesi <10 cm) karşılayan karaciğer apseli 21 hasta çalışmaya dahil edildi.

Bulgular: Hastaların yaş ortalaması 45,6 olup, erkekler kadınlardan fazlaydı. Hastaların çoğu ateş ve karın ağrısı ile başvurdu; çoğunda bulantı/kusma ve az bir kısmında sarılık gözlendi. Ortalama apse hacmi 890 mL idi. İşlem apse hacminin %87'sinden fazlasını etkili bir şekilde boşalttı ve yalnızca bir hastada ek aspirasyon gerekti. İşlem sonrası ağrı, sıfırıncı saatte görsel analog skalada ortalama 3,15 iken taburcu olmadan önce 0,84'e düşmüştür. Ortalama hastanede kalış süresi 2,57 gündü. Herhangi bir komplikasyon veya mortalite bildirilmedi.

Sonuç: Gupta-Akami tekniği, kaynakların sınırlı olduğu ortamlarda karaciğer apselerinin perkütan drenajı için düşük maliyetli, erişilebilir bir yöntem olarak etkinliğini göstermektedir. Daha pahalı geleneksel yöntemlere umut verici bir alternatif sunarak, düşük kaynaklı ortamlarda hasta sonuçlarını ve erişilebilirliği potansiyel olarak iyileştirmektedir.

Anahtar Kelimeler: Karaciğer apsesi, metalik trokar, Ryle tüpü, kateter drenajı, ekonomik yöntem

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