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### *Retrospective Study*

**Comparison of seldinger and trocar techniques in the percutaneous treatment of hydatid cysts**

Turan HG *et al.* Seldinger and trocar techniques in hydatid

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**Abstract**

***AIM***

To comparatively evaluate seldinger and trocar techniques in the percutaneous treatment of hydatid disease.

***METHODS***

Trocar and Seldinger techniques were used for 49 and 56 cysts, respectively, among 106 hydatid cysts of 88 patients. The number of males and females were 22 and 66, respectively with a mean age of 44.9 years (range: 15-87). Follow-up was based on cyst diameter, cyst contents, and morphological changes in the cyst wall, local recurrence, and secondary invasion. Follow-up with ultrasound, computerized tomography and chest X-rays were obtained.

***RESULTS***

The positive criteria of healing were a decrease in cyst diameter, progressive solidification of the cyst contents, and disappearance of the cyst. Local recurrence was defined as, an increase in the cyst diameter and contents and appearance of daughter cysts in the primary cavity, while secondary dissemination was defined as the appearance of new cysts outside the treated cyst. Mean duration of follow-up was 19.23 mo (range: 18-26 mo). Follow-up results demonstrated that no significant differences were present between the trocar and seldinger techniques in the percentage of decrease in the cyst volume, rate of early complications, local recurrence and secondary dissemination (*P* values: 0.384, 0.069, 0.215 and 0.533, respectively).

***CONCLUSION***

No differences have found between the seldinger and trocar techniques that entry to cyst cavity, in terms of the efficacy of the treatment and the rates of early and late complications.

**Key words:** Liver; Cyst hydatid; Percutaneous treatment; Trocar technique; Seldinger technique

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**Core tip:** Although various methods have been developed as interventional procedures, there is no knowledge in the literature on which technique should be used when entering the cyst hydatid cavity. İn this study, no differences have found between the seldinger and trocar techniques that entry to cyst hydatid cavity, in terms of the efficacy of the treatment and the rates of early and late complications. Although trocar technique, is a practical method that is easier and more economical to apply compared with the drainage procedure conducted using seldinger technique, it should not be considered in post-surgical and elderly patients.

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### INTRODUCTION

Although surgery is the long-standing conventional treatment method for the treatment of hydatid cysts, non-surgical alternative methods of treatment have replaced this due to the remarkable rate of complications and the risk of recurrence[1,2]. Although medical treatment with drugs containing benzimidazole constitutes an alternative treatment, the success rate of treatment with these drugs is low and is not curative when used alone[3,4]. Endoscopic treatment is limited to hydatid cysts with biliary tract invasion[5].

Developments in interventional radiology and the successful application of percutaneous methods for other intraabdominal lesions resulted in the percutaneous approach being used for the treatment of cystic echinococcosis, and studies published in the last 30 years have contended that these lesions could be successfully treated using the percutaneous approach[6-18].

Although various methods have been developed as interventional procedures, there is no knowledge in the literature on which technique should be used when entering the cyst cavity. The objective of this study is to compare two different techniques of percutaneous entry and to evaluate their efficacy.

**MATERIALS AND METHODS**

Eightyeight patients with hydatid cysts, between January 2009 and February 2012, were retrospectively evaluated. One hundred and six hydatid cysts in these patients were treated using the percutaneous approach. The patients were followed up until February 2013. The mean duration of follow up was 19.23 mo (range: 18-26). The number of males and females were 22 and 66, respectively, with a mean age of 44.9 years (range: 15-87). Hydatid cysts were classified according to the criteria of Gharbi *et al*[19]. Type 1 and type 2 cysts were included in the study, while type 3 cysts were included only in cases where daughter cysts constituted a small part of the cyst. Type 4 and 5 cysts were excluded from the study. Also, three cysts that were initially diagnosed as hydatid cyst but were later detected to be non-parasitic cysts, were excluded from the study. Among these cysts, 99 had the appearance of type 1 cyst, four were type 2, and three were type 3 cysts. The liver and the peritoneal cavity next to the liver were the locations of the lesions in 104 and two cases respectively. The volume of the cysts varied between 22.5 and 6840 mL (mean volume: 504.4 mL).

***Percutaneous drainage technique***

Oral albendazole treatment was administered in to the patients for a week prior to the procedure, in order to prevent secondary dissemination, at a dose of 10 mg/kg per day. Albendazole treatment was continued for prophylaxis for two further weeks following the procedure[9,20]. In this present study, catheter placement was performed using two different techniques: The seldinger technique and the trocar technique. For the procedure, an 18-22 G (gauge) Chiba needle, 6-10 F percutaneous drainage catheter or 5.7-8 F trocar tip (one-step) drainage catheter was used. The seldinger technique was used in 56 cysts (53%) and the trocar technique was used in 50 cysts (47%).

***Seldinger technique***

This is a two-step procedure. Standard wires and guide wires were used for drainage. The cyst was approached primarily through an intervention needle. Subsequently, a guide wire was sent through this needle and the needle was withdrawn. Thus, the guide wire was located in the area of intervention. With dilators of various diameters sent through this guide wire, a hole was created that would permit the passage of the catheter both through the skin and the region of drainage. Finally, the drainage catheter was placed into the target area over the same guide wire, and the guide wire was withdrawn.

***Trocar technique***

This is a single step procedure and a standard trocar tip drainage catheter is composed of a sheath needle and a catheter coaxial system. A catheter and a straightening cannula of the same size are placed in the catheter and a needle 2-3 mm longer than the catheter is placed one in the other. Through this system, a direct puncture was made and it was forwarded to the field of drainage. Subsequently, the cannula and needle was withdrawn with the catheter remaining inside.

Following the first puncture, the cyst fluid was sent for cytological examination. Mobile scolexes in the cyst, seen under direct microscopy, were accepted as evidence of viability. Cysts without presence of evidence of viability, such as that of laminar membrane fragments and scolex hooks in cytological examination and separation of the endocyst in radiological evaluation, were excluded from the study.
We applied PAIR in cysts with a diameter of less than 6 cm and catheterization method in larger cysts[21-31]. Sixty-two cysts (58%) of 88 patients were treated using the PAIR technique, while the catheterization technique was used in the remaining 44 (42%) cysts[22].

Follow up was performed taking into account the cyst diameter and morphological changes in the cyst wall, local recurrence and secondary dissemination. Follow up with US was performed at the 1, 3, 6, 12, 18 and 24 mo after following the procedure. Annual whole abdominal CT and chest X-rays were obtained. Positive criteria of healing were accepted to be, a decrease in cyst diameter, progressive solidification of the cyst contents and disappearance of the cyst. Local recurrence was defined as increased cyst diameter and contents and the appearance of daughter cysts in the primary cavity, while secondary dissemination was defined as the appearance of new cysts outside the treated cyst.

***Statistical analysis***

SPSS 14.0 statistics software package program (SPSS Inc, Chicago, IL) was used for statistical analysis. The analysis of difference in volume between Trocar and Seldinger methods was performed using Mann-Whitney *U* test. Differences between the two techniques in terms of the rates of complication, local recurrence and secondary dissemination were analyzed using the χ2 test. *P* < 0.05 was accepted as statistically significant.

### RESULTS

Separation of the endocyst from the pericyst was observed in 104 out of 106 cysts following injection of the sclerosing agent. The cyst was drained without observation of membrane separation in one case, due to severe abdominal pain subsequent to hypertonic saline injection. In another patient, the procedure was terminated due to the development of anaphylaxis before the cyst contents could be aspirated, following catheter insertion.

Daughter cysts were ruptured following hypertonic saline injection in two type 3 cysts including daughter cysts among the three type 3 cysts in the total series and in they were ruptured with the manipulation of the catheter/guide wire in one of the type 3 cysts. Cytological examination confirmed the diagnosis of hydatid cyst in 106 cysts, while viability was detected in 98 cysts.

The trocar technique was used in 50 cysts (47%) for entry to the cavity, while the seldinger technique was used in 56 cysts (53%). Sclerotherapy was used in 98 cysts. Sclerotherapy was not performed in eight cysts, although they were catheterized due to contraindications which were biliary fistula (*n*: 4), intraabdominal extravasation (*n*: 2), anaphylaxis (*n*: 1), and absence of cellular elements in histopathological examination (*n*: 1). Mean duration of catheterization in 62 patients was 2.43 (range: 1- 45) d.

The mean duration of the follow-up of the 106 hydatid cysts in 88 patients was 19.23 mo (range: 18-26). Floating membranes were observed in the cyst fluid during the follow-up US examinations 12 mo after the percutaneous treatment, while none of the cysts had a pure anechoic image and they included dense internal echoes. At 12-14 mo follow-up, the cavity was seen to have collapsed, the cyst wall had thickened, and the cyst fluid was indiscernible. Finally, at the previous cyst localization, an image of a solid pseudotumor developed in many cases, which was seen to be iso- or hyperechoic with the liver parenchyma (Figure 1). No statistically significant difference was found in the cyst volume (*P*: 0.384) between the Trocar and Seldinger techniques (Table 1).

Thirteen early complications developed in a total of 12 patients. The early complications were anaphylaxis in one patient, biliary fistula in four, minor reaction in one (chills and tachycardia), abdominal pain in three, fever without signs of infection, entry site infection in one patient, infection in the cyst cavity (abscess) in one patient, in whom a biliary fistula also developed, and intraabdominal extravasation in one patient. Late complications developed in three patients that were secondary dissemination in one and local recurrence in two patients.

During entry to the cavity with the seldinger technique, following catheter placement and before aspiration of the cyst contents, anaphylaxis developed in a 17 year-old male patient with a type 1 cyst. The patient’s vital signs returned to normal following immediate treatment. With the seldinger technique, the catheter was placed in all cysts in which biliary fistula had developed. These cysts were big cysts with a mean diameter of 8 cm (range: 5-11.5 cm). Due to severe abdominal pain, the procedure was terminated in two patients in which the Seldinger technique had been used and in one patient in which the trocar technique was used. Fever, chills and tachycardia developed in one patient on whom the seldinger technique was used; however these signs resolved spontaneously without any medical treatment. Entry site infection was seen in a patient on whom the seldinger technique was used for the procedure, and the patient was treated with antibiotics. Cystography revealed leakage into the peritoneal cavity was detected in two cysts subcapsularly located at the dome of the right lobe of the liver of a patient on whom the seldinger technique was used. This patient was treated with albendazole for three months and no peritoneal cysts were detected in the 24-mo follow up period.

Local recurrence developed in two patients in whom the seldinger technique was used for the procedure. Recurrence was established, which was the presence of multiple daughter cysts and increased dimensions in a cyst cavity that had collapsed and solidified. These two patients underwent surgical treatment. Two new lesions (secondary dissemination, recurrence), were found at the 12 mo follow-up visit in a patient on whom seldinger technique was used. These lesions were also treated using percutaneous methods.

Complication rates, local recurrence and secondary dissemination were statistically similar between the patients on whom the seldinger and trocar techniques were used (Tables 2-4).

### DISCUSSION

Hydatid cyst disease should be treated, due to the risks of severe infection, invasion to the biliary system and peritoneum and dissemination into other organs. Although surgery is the gold standard, various types of percutaneous treatment provide serious alternatives for the elimination of the parasite and preventing the disease from reoccurring[23-25,32]. In different series, the success of percutaneous procedures have been reported to reach 95%-100%[6-19,23,26].

The two step seldinger technique or single step trocar technique may be used for entry to the cyst cavity. The disadvantages in using the hydrophilic coated drainage catheters placed percutaneously with a guide wire, as required by the seldinger technique, is the necessity for two individuals to perform the procedure and the relatively high cost of the technique. Trocar type catheters can be placed by a single individual and are more cost effective. However, secondary to ageing, the pleura and peritoneum lose their elasticity after surgery, making the insertion of trocar type catheters difficult in such cases. There is no publication in the literature reporting whether a difference exists between the two techniques used for the entry to the cyst cavity, in terms of the effectivity of the treatment and the development of complications[15,31,32]. In this present study, seldinger and trocar techniques were used in 56 (53%) and 50 (47%) cysts, respectively, and the differences between the two techniques in terms of effectivity of treatment and complications, if any, were evaluated.

A significant decrease was found in the cyst volume during the follow up period. Furthermore, no statistically significant difference was found in the volume changes between the trocar and seldinger techniques (*P*: 0.384).

The most frequently seen early complication of percutaneous treatment is fever without signs of infection and minor hypersensitivity reactions are probably due to signs that develop secondary to the antigenic stimulus of the parasite, and are treated successfully with symptomatic treatment, as was the case in this present study and in other series previously reported in the literature[3,8,22]. Fistula may develop between the cavity and the biliary system, due to the percutaneous procedure or prolonged drainage. Some of this fistula may close spontaneously, while some necessitate an endoscopic approach in the treatment[8,23,28]. In this present study, biliary fistula developed in four patients, all of whom had undergone percutaneous drainage with the seldinger technique. In large patient series in the literature, the rate of development of anaphylaxis has been reported to be approximately 1%-2% with both percutaneous and surgical techniques[27-29]. When we looked into the cases reported in the literature, spontaneous rupture does not always result in anaphylaxis[30]. In this present study, an anaphylactic reaction developed in one patient during the PAIR procedure following catheter placement with seldinger technique, however the medical treatment was successful. No statistically significant differences between the two techniques used for the entry to the cyst were found in terms of the rates of development of early complications, such as anaphylaxis, biliary fistula, minor reactions, abdominal pain, entry site infection, infection in the cyst cavity and intraabdominal extravasation (*P*: 0.069).

Rates of local recurrence and secondary dissemination were reported to be 0%-4% in the literature[3,6,22]. In this present study, local recurrence and secondary dissemination occurred in two patients and one patient, respectively. In this present study, no statistically significant association was found in the rates of local recurrence and secondary dissemination between the two techniques (*P* = 0.215, *P* = 0.533).

In conclusion, no differences were found between the seldinger and trocar techniques that might be used in the entry to cyst cavity, in terms of the efficacy of the treatment and the rates of early and late complications. Although percutaneous cyst drainage, conducted with a trocar type catheter, is a practical method that is easier and more economical to apply compared with the drainage procedure conducted using a seldinger needle, guide wire and a catheter, it should be considered in post-surgical and elderly patients that the trocar type catheter placement might be more difficult to apply, due to decreased elasticity of the pleura and peritoneum, in such cases.

**COMMENTS**

***Background***

Although various methods have been developed as interventional procedures, there is no knowledge in the literature on which technique should be used when entering the liver cyst hydatid cavity. Two step seldinger technique or single step trocar technique may be used for entry to the cavity. The objective of this study is to compare two different techniques of percutaneous entry and to evaluate their efficacy.

***Research frontiers***

The weakness points are the small sample of patients and the retrospective design of the study but it can represent an interesting report for literature as first evaluation of compare two different techniques of percutaneous entry. Further studies with a larger number of patients will be needed to confirm data.

***Innovations and breakthroughs***

No differences were found between the Seldinger and trocar techniques that might be used in the entry to cyst cavity, in terms of the efficacy of the treatment and the rates of early and late complications. Although percutaneous cyst drainage, conducted with a trocar type catheter, is a practical method that is easier and more economical to apply compared with the drainage procedure conducted using a Seldinger needle, guide wire and a catheter, it should be considered in post-surgical and elderly patients that the trocar type catheter placement might be more difficult to apply, due to decreased elasticity of the pleura and peritoneum, in such cases.

***Applications***

Seldinger technique: This is a two-step procedure. Standard wires and guide wires were used for drainage; Trocar technique: This is a single step procedure and a standard trocar tip drainage catheter is composed of a sheath needle and a catheter coaxial system.

***Terminology***

PAIR technique: The Puncture Aspiration Injection Reaspiration (PAIR) technique is performed using either ultrasound or CT guidance, involves aspiration of the cyst contents via a special cannula, followed by injection of a scolicidal agent and then reaspiration of the cystic contents; US: Ultrasound; CT: Computerized tomography.

***Peer-review***

This study compared two percutaneous technique on treatment of hydatid cysts.

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Grade E (Poor): 0

 

 A. B.

  

 C. D.

 

 E.

**Figure 1 Type 1 hydatid cyst follow-up examinations conducted one to 18 mo after the procedure.** A: US image prior to the procedure; B: CT image prior to the procedure; C: US image 6 mo after the procedure, wall thickness and irregularity of the cyst is seem to be increased; D: US image 12 mo after the procedure, cyst dimension and tension is seem to be markedly decreased and the contents can be seen to have solidified; E: US image 18 mo after percutaneous drainage. Cyst can be seen to have completely collapsed and solidified in the image and a pseudotumor image is formed. US: Ultrasound; CT: Computerized tomography.

**Table 1 Statistical evaluation of the changes in cyst volume between Trocar and Seldinger techniques (Mann-Whitney *U* test)**

|  |  |  |  |  |  |  |
| --- | --- | --- | --- | --- | --- | --- |
| **Method** | ***n***  | **Mean rank**  | **Lower and upper- median**  | **Mann-Whitney *U***  | ***P***  | **Difference** |
| Trocar | 50  | 50.23  |  -165.00 and 97.00  61.00 |  |  |  |
|  |  |  |  | 1236.500 | 0.384 | None |
| Seldinger | 56  | 55.42  |  -29.00 and 100.00 70.50 |  |  |  |

**Table 2 Association of the technique and rate of complications (*χ*2 analysis)**

|  |  |  |  |  |  |  |
| --- | --- | --- | --- | --- | --- | --- |
|  |  | **Trocar** | **Seldinger**  | **Total**  | ***χ*2**  | ***P* value** |
| **Development of**  | Yes, *n* % |  3 6.1 |  10 17.9 |  13 12.4 |  |  |
| **Complication** | No, *n* % |  47 93.9 |  46 82.1 |  93 87.6 | 3317 | 0.069 |
| **Total** |  N % |  50 100 |  56 100 |  106 |  |  |

**Table 3 Association of the technique and rate of local recurrence (*χ*2 analysis)**

|  |  |  |  |  |  |
| --- | --- | --- | --- | --- | --- |
|  |  **Trocar** | **Seldinger** | **Total** | ***χ*2**  | ***P* value** |
| **Local recurrence present, *n*** **%** |   2 4 |   0 0 |   2 1.9 |  |  |
| **Local recurrence none, *n*** **%** |   48 96 |   56 100 |   104 98.1 |   2330 | 0.215 |
| **Total, *n*** **%** |   50 100 |   56 100 |   106 100 |  |  |

**Table 4 Association of the technique and rate of secondary dissemination (*χ*2 Analysis)**

|  |  |  |  |  |  |
| --- | --- | --- | --- | --- | --- |
|  | **Trocar**  | **Seldinger**  | **Total**  | ***χ*2**  | ***P* value** |
| Secondary dissemination present, *n* % |   0 0 |   1 1.8 |   1 1 |  |  |
| Secondary dissemination none, *n* % |   50 100 |   55 98.2 |   105 99 |   0.883  | 0.533 |
| Total, *n* % |   50 100 |   56 100 |   106 100 |  |  |