

Retrospective Study

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

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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 in 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 studies included cyst diameter, cyst contents, and morphological changes in

the cyst wall, local recurrence, and secondary invasion, using ultrasound, computerized tomography and chest X-rays.

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 ($P = 0.384, 0.069, 0.215$ and 0.533 , respectively).

CONCLUSION

There are no differences between the Seldinger and Trocar techniques that gain entry to the cyst cavity in terms of the efficacy of the treatment and the rates of early and late complications.

Key words: Percutaneous treatment; Trocar technique; Liver; Cyst hydatid; 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. In this study, no differences have been found between the Seldinger and Trocar techniques that gain entry to the 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 a long-standing conventional treatment for the hydatid cysts, non-surgical alternative options have been used instead due to its remarkable

rate of complications and the risk of recurrence^[1,2]. Drugs containing benzimidazole constitute an alternative treatment, but the success rate is low and are not curative when used alone^[3,4]. Endoscopic treatment is limited to hydatid cysts with biliary tract invasion^[5].

Development in interventional radiology and the successful application of percutaneous methods for other intra-abdominal lesions resulted in the percutaneous approach being used for the treatment of cystic echinococcosis, and studies over the past 30 years have proved 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 aim of this study is to compare two different techniques for percutaneous entry and to evaluate their efficacy.

MATERIALS AND METHODS

Eighty-eight patients with hydatid cysts treated 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. And 104 and two cases were located in the liver and the peritoneal cavity next to the liver, respectively. The volume of the cysts varied between 22.5 and 6840 mL (mean volume, 504.4 mL).

Percutaneous drainage technique

Oral albendazole at a dose of 10 mg/kg per day was administered to the patients for a week prior to the procedure in order to prevent secondary dissemination. Albendazole treatment was continued for prophylaxis for two further weeks following the procedure^[9,20]. Catheter placement was performed using two different techniques: the Seldinger technique and the Trocar technique. 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 could be 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 through both 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 were placed in the catheter and a needle 2-3 mm longer than the catheter was 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 Puncture Aspiration Injection Reaspiration (PAIR) in cysts with a diameter of less than 6 cm and catheterization method in larger cysts^[21-31]. Sixty-two cysts (58%) in 88 patients were treated using the PAIR technique, while the catheterization technique was used in the remaining 44 (42%) cysts^[22].

Follow-up studies included 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 the procedure. Annual whole abdominal CT and chest X-ray examinations were also performed. 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, United States) 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 χ^2 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 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 of biliary fistula ($n = 4$), intra-abdominal 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, which 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, solid pseudotumors 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

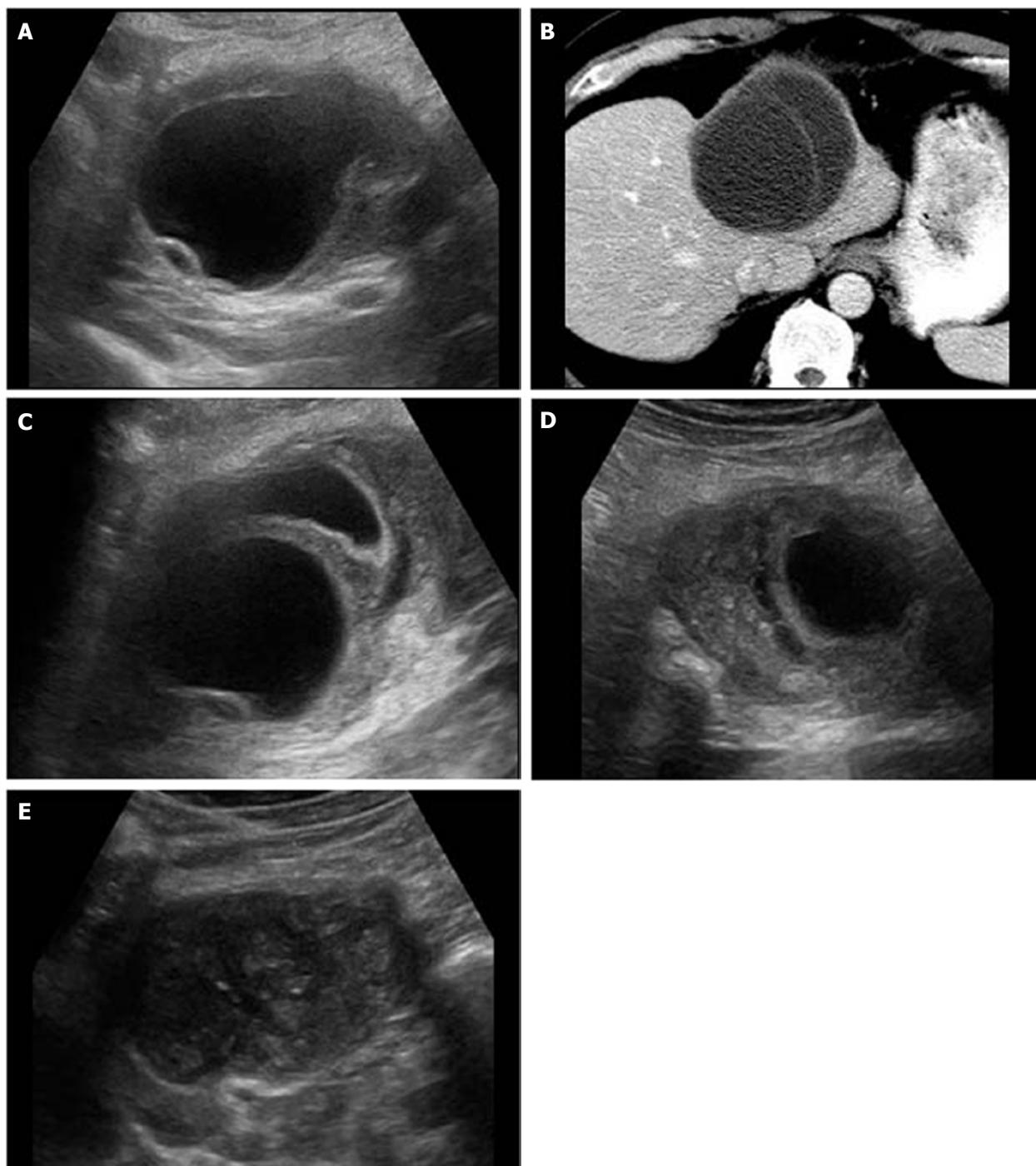


Figure 1 Type 1 hydatid cyst follow-up examinations conducted one to 1-18 mo after the procedure. A: US image prior to the procedure; B: CT image prior to the procedure; C: US image 6 mo after the procedure, wall thickness and irregularity of the cyst is seemed to be increased; D: US image 12 mo after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

one patient, infection in the cyst cavity (abscess) in one patient, in whom a biliary fistula also developed, and intra-abdominal 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

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

Method	<i>n</i>	Mean rank	Lower and upper- median	Mann-Whitney <i>U</i>	<i>P</i> value	Difference
Trocar	50	50.23	-165.00 and 97.00 61	1236.5	0.384	None
Seldinger	56	55.42	-29.00 and 100.00 70.5			

Table 2 Association of the techniques used and rate of complications (χ^2 analysis)

		Trocar	Seldinger	Total	χ^2	<i>P</i> value
Development of complications	Yes, <i>n</i>	3	10	13	3317	0.069
	(%)	6.1	17.9	12.4		
No, <i>n</i>	47	46	93			
(%)	93.9	82.1	87.6			
Total	<i>n</i>	50	56	106		
	(%)	100	100			

Table 3 Association of the techniques used and rate of local recurrence (χ^2 analysis)

		Trocar	Seldinger	Total	χ^2	<i>P</i> value
Local recurrence, present, <i>n</i>		2	0	2	2330	0.215
	(%)	4	0	1.9		
Local recurrence, none, <i>n</i>		48	56	104		
	(%)	96	100	98.1		
Total	<i>n</i>	50	56	106		
	(%)	100	100	100		

in two patients treated with the Seldinger technique and in one patient treated with the Trocar technique. Fever, chills and tachycardia developed in one patient with the Seldinger technique; however these signs resolved spontaneously without any medical treatment. Entry site infection was seen in a patient using the Seldinger technique, and the patient was treated with antibiotics. Cystography revealed leakage into the peritoneal cavity in two cysts subcapsularly located at the dome of the right lobe of the liver in a patient using the Seldinger technique. This patient was treated with albendazole for three months and no peritoneal cysts were detected during the 24-mo follow-up period.

Local recurrence developed in two patients using the Seldinger technique, including 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 and recurrence) were found at the 12 mo follow-up visit in a patient using Seldinger technique. These lesions were also treated by percutaneous methods.

Complication rates, local recurrence and secondary dissemination were statistically similar between the

patients using the Seldinger and Trocar techniques (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 treatment, various types of percutaneous treatment provide alternatives for the elimination of the parasite and preventing the disease from reoccurring^[23-25,32]. In different series, the success rate of percutaneous procedures has been reported to be 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, are 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 aging, the pleura and peritoneum lose their elasticity after surgery, making the insertion of

Table 4 Association of the techniques used and rate of secondary dissemination (χ^2 analysis)

	Trocar	Seldinger	Total	χ^2	P value
Secondary dissemination, present, <i>n</i>	0	1	1	0.883	0.533
(%)	0	1.8	1		
Secondary dissemination, none, <i>n</i>	50	55	105		
(%)	100	98.2	99		
Total, <i>n</i>	50	56	106		
(%)	100	100	100		

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 efficacy of treatment and the development of complications^[15,31,32]. In the 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 the efficacy 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 two techniques ($P = 0.384$).

The most frequently seen early complication of percutaneous treatment is fever without signs of infection and minor hypersensitivity reactions 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 the 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 the fistulae may close spontaneously, while some necessitate an endoscopic approach in the treatment^[8,23,28]. In the 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 the 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 the present study, local recurrence and secondary dissemination occurred in two patients and one patient, respectively. 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 was 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 comparing two different techniques of percutaneous entry. Further studies with a larger number of patients will be needed to confirm the 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 is a two-step procedure, and standard wires and guide wires were used for drainage. Trocar technique 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 technique is performed using either ultrasound or CT guidance, involves aspiration of the cyst contents via a special cannula, followed by injection of a scolicalid agent and then reaspiration of the cystic contents. US: Ultrasound; CT: Computerized tomography.

Peer-review

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

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