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RESEARCH PAPER

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Surgical Management of Hydatid Cysts of Liver by Using Different Scolicidal Agents

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ABSTRACT

Surgery is the treatment of choice for uncomplicated hydatid cyst of the liver since the results of medical and percutaneous treatment are still controversial. In the surgical management of this disease, neutralization of the parasite, evacuation of the cyst and the management of the residual cavity are the principal steps. Prevention of spillage into the peritoneal cavity and wound edges is very important. Injecting a scolicidal agent into the unopened cyst and walling off the operative field with sponges soaked in a scolicidal agent are the two most commonly employed measures although the effectiveness of these measures is not confirmed. 10% povidone iodine, formalin, hypertonic saline, cetrimide, chlorhexidine, hydrogen peroxide and ethyl alcohol are some of the compounds commonly used as scolicidal agents. All are exposure time and concentration dependent and their degree of dilution in the cyst contents is quite unpredictable. In first part of study, we tried to find out the scolicidal effects of various agents in different concentrations and exposure times and to check if scoleces sprayed on sponges soaked in different type and concentrations of scolicidal agents could survive after 15 minutes.

In the second part, we tested whether sponges soaked in different type and concentrations of scolicalidal agents have any role beyond being a mechanical barrier.

The main aim of this study is to determine in an in vitro basis if the practices of injecting scolicalidal agents into the cyst and walling off the operative field with packs soaked in scolicalidal agents are likely to achieve the effect for which they are performed.

Keywords: Hydatid cyst, Liver, Surgical Management and Scolicalidal agents.

INTRODUCTION

Hydatid disease or echinococcosis is a zoonosis that occurs primarily in sheep-grazing areas of the world, but is common worldwide because the dog is a definitive host. There are three species that cause hydatid disease. *Echinococcus granulosus* is the most common and *Echinococcus multilocularis* and *Echinococcus ligartus* account for a small number of cases (**Sabiston textbook of surgery; 19th edition**). Dogs are the definitive host of *E. granulosus*; the adult tapeworm is attached to the villi of the ileum. Sheep are the usual intermediate host, but humans are an accidental intermediate host. Humans are an end stage to the parasite. In the human duodenum, the parasitic embryo releases an oncosphere containing hooklets that penetrate the mucosa, allowing access to the bloodstream. In the blood, the oncosphere reaches the liver (most commonly) or lungs, where the parasite develops its larval stage the hydatid cyst. The cyst wall itself has two layers, an outer gelatinous membrane (ectocyst) and an inner germinal membrane (endocyst).

The treatment of hepatic hydatid cysts is primarily surgical. In general, most cysts should be treated, but in older patients with small, asymptomatic, densely calcified cysts, conservative management is appropriate.

Aim of Study

To compare effectiveness of 10% povidone iodine, Formalin, hypertonic saline, cetrimide, hydrogen peroxide, silver nitrate, and ethyl alcohol as a

scolicalidal agent in Liver hydatid cyst surgery and their further dilutions were used for optimal result.

MATERIALS AND METHODS

All patients with hydatid cysts in the liver who presented at our institution between January 2013 and July 2015 were considered candidates for the study. A patient was enrolled if he or she had symptoms and signs of a hepatic mass caused by a hydatid cyst and if the cyst had a prominent fluid component that appeared anechoic or hypoechoic with marked enhancement of back-wall echoes. Women were excluded if they were pregnant or intended to conceive during the study period. Hepatic hydatidosis was diagnosed in 56 patients during the study period, 5 patients of whom were excluded because of infected cysts, 3 patients with a hyperechoic solid pattern or calcified walls, or cysts with biliary rupture. Of the remaining 48 patients gave written informed consent and assigned for surgery, after discharging the patients we start to follow him by Liver Function Test, Ultrasonography and CT scan checking for recurrence in the liver or in the abdominal cavity and complication due to leakage of hydatid fluid and scolicalidal agents.

For this *in vitro* study (**Caglar et al., 2008**), we used scolex solutions collected from 48 patients who underwent operations for liver hydatid disease at the Integral Institute of Medical Science and Research Centre, Integral University, Lucknow, India, Department of General Surgery, from 2013 to 2015. All samples were

examined and identified at the Integral Institute of Medical Science and Research Centre, Integral University, Lucknow, India, Department of Microbiology and Clinical Microbiology.

In the first part, we tested whether sponges soaked in different type and concentrations of scolical agents have any role beyond being a mechanical barrier and to determine the scolical property of various agents in different concentrations and exposure times.

In the second part of this study, we follow up patients by Liver Function Test, Ultrasonography and CT scan checking for recurrence in the liver or in the abdominal cavity due to leakage of hydatid fluid, and scolical agents.

20% saline, 3% hydrogen peroxide, 1.5% cetrimide-0.15% chlorhexidine (10% savlon®), 95% ethyl alcohol, 10% polyvinyl pirrolidone-iodine (Betadine®) and their further dilutions were used for optimal result in this study.

Protoscoleces were obtained from biopsy containing the cyst and viability was determined with dye uptake (0.1% Eosin) and flame cell activity (Smyth and Barret, 1980). Savlon® was found to be the least concentration dependent scolical agent

among those studied. Scoleces sprayed on sponges soaked in 20% saline, 95% ethyl alcohol, betadine® and 3% hydrogen peroxide were killed after 15 minutes. 3% and 10% saline and normal saline were ineffective.

RESULTS

In first part of this study savlon® solution was very effective in all concentrations up to 1% savlon® and themorphology of the protoscoleces was distorted after coming in contact with this substances shows in table 1.

Betadine® it's undiluted and 50% diluted forms were both effective in terms of killing the protoscoleces but when the concentration was lowered to 10% (1% polyvinyl pirrolidone-iodine), the protoscoleces were found to be alive after 5 or 10 minute exposures.

Hypertonic saline was effective in both 20% and 10% diluted forms but no scolical property can be shown with 0.9% hypertonic saline even at the 10 minutes exposure.

95% ethyl alcohol was found to be effective only in undiluted forms. Further dilutions of 47% and 9.5% ethyl alcohol were all ineffective scolical agents.

Table 1. Scolical effects of selected agents and exposure times.

Exposure time	5 minutes		10 minutes		15 minutes	
	Test	Viability	Test	Viability	Test	Viability
Savlon®	E(+) FCA(-)	Dead	E(+) FCA(-)	Dead	E(+) FCA(-)	Dead
Povidine-iodine 10%	E(-) FCA(+)	Live	E(+) FCA(-)	Dead	E(+) FCA(-)	Dead
Hypertonic saline 20%	E(-) FCA(+)	Live	E(+) FCA(-)	Dead	E(+) FCA(-)	Dead
Alcohol	E(-) FCA(+)	Live	E(-) FCA(+)	Live	E(+) FCA(-)	Dead

E: 0.1% Eosin, FCA: Flame cell activity, savlon(R): 15% cetrimide-1.5% chlorhexidine.

The results of this second part of this study showed that savlon® is a very

potent scolical, agent even at very low concentrations that makes it the scolical

agent of choice in the situations where it is hard to anticipate the volume of the cyst and adjust for dilution of the scolicial agent.

Table 2 shows increase in liver enzymes SGPT and SGOT in savlon® group 20%, in povidone iodine group 27%, in hypertonic saline group 15% and in alcohol group 40% is reported.

Increase level of total serum bilirubin in savlon® group in 2 patients (5%), in with povidone iodine 10% group 3 patients (7.5%) and in hypertonic saline group 5 patients (12.5%) and in alcohol group 7 (17.5%) patients.

In savlon® group there is 1 patient(2.5%) got post-operative collections (sub phrenic ,sub hepatic and intra cystic

abscesses) while in povidone iodine group 3 patients (7.5%) and in hypertonic saline group 4 (10%) patients and in alcohol group 6 patients (15%) recorded. Wound infection in savlon® group one patients (2.5%) while in povidone iodine group 03 patients (7.5%), in hypertonic saline group 08 patients (20%) and in alcohol groups 06 patient (15%) during post-operative period.

In follow up period there is low recurrence rate in patients using savlon® during surgery, only one patients (2.5%) but with povidone iodine 03 (7.5%) patients, with hypertonic saline 05(12.5%) patients and with alcohol 07 (17.5%) patients. (Fig. 1).

Table 2. Post-operative complications that occur with uses of different Scolicial Agents.

Complication	Savlon®	Povidine-iodine 10%	Hypertonic saline	Alcohol
Increase level of liver enzymes	20%	25%	15%	30%
Increase level of serum bilirubine	5%	7.5%	12.5%	17.5%
Post-operative collection	2.5%	7.5%	10%	15%
Wound infection	2.5%	7.5%	20%	15%
Recurrence rate	2.5%	7.5%	12.5%	17.5%

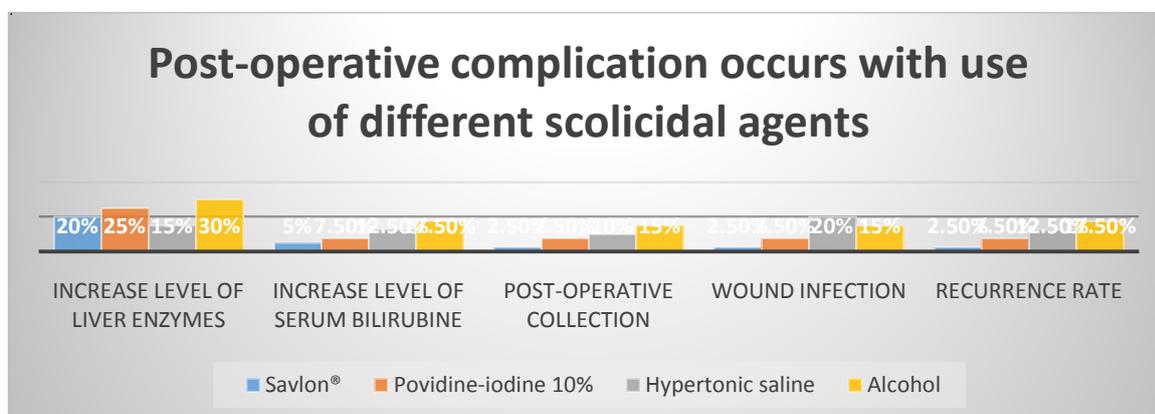


Figure 1. Post-operative complication occurs with use of different scolicial agents

DISCUSSION

Scolicidal Agents

Early on, surgical management of hydatid cysts via cyst evacuation resulted in a high rate of peritoneal implantation. This problem prompted the use of scolicidal agents for injection into the cyst and for use in the surrounding peritoneum. Formalin, hypertonic saline, cetrimide, hydrogen peroxide, polyvinyl pyrrolidone-iodine, silver nitrate, and ethyl alcohol are among some of the many agents that have been used. However, formalin caused sclerosing cholangitis when it entered the biliary tract. Hypertonic saline has to be used carefully to avoid biliary injection and hypernatremia. The safety of the other agents in the biliary tree has not been established. No agent should be injected pre-evacuation due to high intracyst pressure.

Packing the operative field with sponges soaked in scolicidal agents and injecting scolicidal solutions into the hydatid cyst have been used to avoid dissemination of the parasite during surgery.

Sponges work not only as a mechanical barrier but also as a chemical one if the scolicidal agent is chosen correctly. In purely cystic hydatid liver disease, the risk of dissemination of the cyst contents can be avoided by injection of a potent scolicidal agent such as savlon®.

Although surgery is considered the treatment of choice for hydatid disease of the liver but the preferred operative technique for management of the residual cavity and the use of scolicidal agents is still controversial. It has been traditional to inject scolicidal agents into the unopened hydatid cyst because of the risk of spillage into the peritoneal cavity leading to recurrent disease. Cyst fluid contains thousands of protoscolices and each has the potential to grow into a new hydatid cyst.

Among the various scolicidal agents advocated in the past, formalin was the first and most frequently used agent. Despite its effectiveness, it is no longer used because of the associated toxicity (**Aggarwal and Garg, 1983**).

Ethyl alcohol is the scolicidal agent that is usually preferred for ultrasonic-guided percutaneous aspiration, injection and re-aspiration (PAIR) of hydatid cysts (**Filice, 1990 and Giorgio, 1992**). Unfortunately, it can cause caustic damage to the epithelium of communicating bile ducts leading to sclerosing cholangitis and it is strongly concentration dependent (**Castellano, 1994**).

Hydrogen peroxide has not gained wide acceptance because of low efficacy and complications (**Castellano, 1994**).

Betadine(R) is a disinfectant that is used as a scolicidal agent by many surgeons but PVP (polyvinyl pyrrolidone) storage disease, renal shutdown, sterile peritonitis and sclerosing serositis are the associated complications and its use is restricted to preoperative local antisepsis of intact adult skin (**Le Veen et al., 1993**).

Hypertonic saline and cetrimide have become the scolicidal agents of choice over the past years. Although it was demonstrated that 5% saline has no effect on scoleces, many surgeons have recommended the use of 3% saline (**Little and Deane, 1988 and Magistrell et al., 1991**). Our results support the findings of **Saidi (1976) and Besim et al., (1998)** as no scolicidal effect can be shown with a concentration of less than 10% saline at 5 minutes. Lowest concentration of saline should be 20% and it should not be used in patients who have cysts communicating with biliary tree because of the danger of causing caustic sclerosing cholangitis (**Belghiti et al., 1986**) Cetrimide is a potent disinfectant and effective scolicidal agent (**Ahrari, 1978, Frayha et al., 1981 and Gilchrist, 1979**). Low concentrations of

cetrimide (0.1-0.5%) have been used by many surgeons (**Frayha et al., 1981 and Gilchrist, 1979**).

We used cetrimide with chlorhexidine that was also recommended as a scolical agent (**Langer et al., 1984**) because this combination is a widely available disinfectant solution named as savlon®.

The results of this study showed that savlon® is a very potent scolical agent even at very low concentrations that makes it the scolical agent of choice in the situations where it is hard to anticipate the volume of the cyst and adjust for dilution of the scolical agent.

Although cetrimide is effective in very low concentrations, it is not devoid of complications. Gilchrist (**1979**) reported three cases of sclerosing peritonitis after peritoneal washout to prevent secondary hydatidosis. Metabolic acidosis and methemoglobinemia were the two other reported complications due to cetrimide installation into hydatid cysts (**Ahrari, 1978, Frayha et al., 1981 and Gilchrist, 1979**). The effect of cetrimide on the biliary duct epithelium has not so far been studied which makes its use questionable in the cases with cysts communicating with the bile ducts.

Walling off the surgical field with laparotomy sponges or packs soaked in scolical agents is an effective and logical means of using scolical agents if the agent is chosen correctly. Now a days it is a common practice to inject scolical agents into hydatid cysts, lack of objective evidence about the efficacy and the presence of toxicity associated with the scolical agents have led many surgeons to abandon this routine step in the operative management of hydatid cysts (**Langer et al., 1994, Little and Deane, 1988 and Magistrelli et al., 1991**). Particularly in multi vesicular cysts, daughter cysts will not be influenced as it is impossible to puncture each of them. However in purely

cystic hydatid liver disease, the risk of dissemination of the cyst contents can be avoided by injecting a potent scolical agent such as savlon®.

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