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Original Article

Hydrogen peroxide test for intraoperative bile leak detection

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ABSTRACT

Background: Bile leakage (BL) is a common complication following liver surgery, ranging from 3 to 27% in different series. To reduce the incidence of post-operative BL various BL tests have been applied since ages, but no method is foolproof and every method has their own limitations. In this study we used a relatively simpler technique to detect the BL intra-operatively. Topical application of 1.5% diluted hydrogen peroxide (H_2O_2) was used to detect the BL from cut surface of liver and we compared this with conventional saline method to know the efficacy.

Methods: A total of 31 patients included all patients who underwent liver resection and donor hepatectomies as part of Living Donor Liver Transplantation. After complete liver resection, the conventional saline test followed by topical diluted 1.5% H_2O_2 test was performed on all.

Results: A BL was demonstrated in 11 patients (35.48%) by the conventional saline method and in 19 patients (61.29%) by H_2O_2 method. Statistically compared by Wilcoxon signed-rank test showed significant difference ($P = 0.014$) for minor liver resections group and ($P = 0.002$) for major liver resections group.

Conclusion: The topical application of H_2O_2 is a simple and effective method of detection of BL from cut surface of liver. It is an easy, non-invasive, cheap, less time consuming, reproducible, and sensitive technique with no obvious disadvantages.

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Introduction

Bile leakage (BL) following liver surgery is quite common that results in increase in post-operative morbidity like peritonitis, septicemia, and even liver failure.[1,2] These days hepatic resections are being performed with increasing frequency because of recent advancement in operative technology. The post-operative mortality rate after liver resections is decreasing, but post-operative BL still remains a most common complication following liver resection and it ranges from 3 to 27% in different series.[2–5] To reduce the incidence of post-operative BL various BL tests have been applied since ages, but no method is foolproof and every method has their own limitations.

In this study, we used a relatively simpler technique to detect the BL intra-operatively. Topical application of 1.5% diluted hydrogen peroxide (H_2O_2) was used to detect the BL from liver parenchymal transaction surface and compared this with conventional saline method to know the efficacy.

Materials and methods

A total of 31 patients including all patients who underwent elective liver resection and donor hepatectomies as part of Living Donor Liver Transplantation (LDLT) were included. The period of study was for 2 years, from June 2013 to May 2015. Operations are classified according to the Brisbane terminology proposed by Strasberg et al.[6]

Intervention

The liver parenchymal transection was done with Cavitron Ultrasonic Surgical Aspirator (CUSA). The bleeding and BL points from the cut surface of liver is controlled and secured with sutures. The conventional normal saline test and the hydrogen peroxide test are performed on the same patient. To carry out the conventional test, a catheter is inserted through the cystic duct into the common bile duct and 20 mL of isotonic sodium chloride solution is injected via the catheter under pressure while occluding the distal common bile duct with a clamp. The transected liver surface is inspected by two surgeons for the leakage of any sodium chloride solution. The total number of BL sites are counted. 1.5% diluted H_2O_2 is then applied over the cut surface of the liver (Picture 1). H_2O_2 on contact with the cut surface decomposes into water and active oxygen radicals, which bleaches the blood and liver tissues creating a vigorous white froth against which the yellow bile gets highlighted at the cut surface of liver (Picture 2). The number of BL site is again counted. After completing the tests, the detected BL sites are closed with 5-0 polydioxanone suture. Drainage of the operative field is performed with a subhepatic tube drain.

Picture 1 – Performing 1.5% diluted hydrogen peroxide test.

Picture 2 – Bile leak gets highlighted in white background with H_2O_2.

Outcome

Post-operative BL is defined as per definition given by International Study Group of Liver Surgery (ISGLS)[7] i.e. bilirubin concentration in the drain fluid is three times the serum bilirubin level on or after post-operative day 3.

Statistical analysis

Sample size is calculated on the basis of an expected difference of 2.0 between the mean number of BL sites detected by the conventional method and the diluted H_2O_2, with an estimated standard deviation of 2.0. Using a significance level of 0.05 (two sided) and a power of 0.95, at least 18 hepatectomized patients are required for the study. We have done 31 cases in a period of 2 years. The continuous variables are expressed as the mean ± SD. A Wilcoxon signed-rank test is used to compare the number of BL sites identified by the conventional method and the diluted H_2O_2 in each patient. Differences at $P < 0.05$ is considered statistically significant.

Results

A total of 31 patients who have undergone hepatic resection including LDLT in 2 years were included. The indications of liver resection are as shown in Fig. 1. Out of 31 patients, 20 (65%) were male and 11 (35%) were female. The mean age of

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