A DIFFERENTIAL STUDY OF USING

THE LITHOTRIPTER

AND

SURGERY

IN TREATMENT OF GALL STONES

THESIS

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TABLE OF CONTENTS

INTRODUCTION

Cholecystectomy remains the corner-stone treatment for most patients with symptomatic gall stones. This operation now has passed the test of a century, and still the gold standard with which all other therapeutic techniques must compete. It nevertheless, involves considerable discomfort to the patient, prolonged hospitalization and time off from work with all attendant financial implications besides the possible operative and postoperative complications especially in high risk patients.

In order to avoid these drawbacks of operative cholecystectomy, recently several innovative nonsurgical therapies for symptomatic gall stones have emerged, including oral chemolytic drugs, percutaneous contact dissolution with solvents, percutaneous cholecystostomy, laparoscopic cholecystectomy, and extracorporeal shock wave lithotripsy (ESWL).

However, nonsurgical management of gall stones is clearly in its infancy as a new area of medical practice. Many refinements in technology and subsequent time for clinical assessment will be required before sound assessments of the roles of the various methods can be offered.

Walter B. Cannon was one of those great scientists whose mind reached far beyond one area of investigation and bridged the gaps between different disciplines. In his famous book, The Way of an Investigator, he wrote "that there are general principles or organization and that the methods of maintaining stability in the highly complex and very unstable material of which our bodies are composed may have suggestive importance in showing what might be done in the social organism to assure its stability".

Shock wave lithotripsy of gall stones is a theme that fits a Walter B. Cannon words well because it is broad and encompasses many aspects of medicine. It comprises stone imaging and fragmentation by physical means as well as fragment dissolution by chemical processes, thus requiring interdisciplinary cooperation. Many physiologic processes, such as the secretion of bile and the motility of the gall bladder, contribute to fragment clearance. Hence, an understanding of the physiology and pathophysiology of the biliary system is the basis for optimal therapy.

Since the Food and Drug Administration (FDA) approved the extracorporeal shock wave lithotripsy in 1984, renal stones have been successfully treated in more than 500,000 patients. Because of these results, the FDA approved the investigational use of this method in the treatment of cholesterol gall stones.

This noninvasive procedure uses shock waves to shatter gall stones, reducing them to small particles that can pass from the gall bladder spontaneously or be dissolved by an oral bile acid. The traditional method of managing gall stones (cholecystectomy) is thus avoided. The procedure requires no incision, no long hospitalization, and no extended recuperative period. Patients are treated as outpatients, and most return to their regular daily routine within 48 hours of discharge.

We herein report our preliminary experience with ESWL in the management of 100 patients with symptomatic cholesterol gall stones, comparing it with operative cholecystectomy regarding effectiveness, safety profile, patient discomfort, and cost-benefit ratio.

REVIEW OF THE LITERATURE

ANATOMY

Gall bladder and extrahepatic biliary system:

Duct system:

The extrahepatic biliary system begins with the hepatic ducts and ends at the stoma of the common bile duct in the duodenum. The right hepatic duct is formed by the intrahepatic confluence of dorsocaudal and ventrocranial branches. The former enters with a sharp curve, which accounts for the fact that calculi are less common in this segment. The left hepatic duct is longer than the right and has a greater propensity for dilation as a consequence of distal obstruction. The two ducts join to form a common hepatic duct which is 3-4 cm in length. It, in turn, is joined by the cystic duct at an acute angle to form the common bile duct (Schwartz, 1984)

The common bile duct is 3 inches (7-8 cm) long, having approximate diameter of 0.5 to 0.7 cm, and is best described in 3 parts. The upper third lies in the free edge of the lesser (gastro-hepatic) omentum in the most accessible position for surgery - in front of the portal vein and to the right of the hepatic artery. Its middle third lies behind the first part of the duodenum, and slopes down to the right, away from the vertical portal vein. It leaves the hepatic artery here. It lies on the inferior vena cava. The lower third of the common bile duct slopes down to the right behind the head of the pancreas. It lies in a deep groove, sometimes in a tunnel, on the posterior surface of the pancreas, in front of the right renal vein. It opens, in common with the main pancreatic duct, into a spindle-shaped dilation, called the ampulla (of Vater).

The portions of the common bile duct have also been named according to their relationships to intestinal viscera. The terms suprapancreatic, intrapancreatic and intraduodenal have been applied.

The union of the common bile duct and the main pancreatic duct follows one of three patterns. The structures may (1) unite outside the duodenum and traverse the duodenal wall and papilla as a single duct, (2) join within the duodenal wall and have a short, common, terminal portion, or (3) exit independently into the duodenum. Separate orifices have been demonstrated in 29% of autopsied specimens, while injection into cadavers reveals reflux from the common bile duct into the pancreatic duct in 54%. Radiologically, reflux from the common bile duct into the pancreatic duct is present in about 16% of the cases.

The ampulla itself opens in the posteromedial wall of the second part of duodenum at a small papilla four inches (10 cm) from the pylorus (Last, 1985).

The common opening of the common bile duct and the pancreatic duct is surrounded by a circular muscle (The sphincter of Oddi). Each duct, in addition, possesses its own sphincter, so that bile or pancreatic juice can be discharged independently into the duodenum. Some longitudinal fibres recurve into the papilla. Their contraction makes the papilla pout (a dilator mechanism). Some of the circular and longitudinal fibres blend with the muscle wall of the duodenum to anchor the papilla in place.

Blood supply of the duct system:

The lower part of the common bile duct receives several branches from the posterior superior pancreatico-duodenal artery, while the upper part of the common bile duct and the hepatic ducts are supplied with branches from the cystic artery. The right hepatic artery gives branches to the middle part of the common bile duct, though these are very small, the main supply being from the cystic and posterior superior pancreatico-duodenal arteries. There is considerable variations in the arrangement of the above vessels.

The posterior superior pancreatico-duodenal artery ends below by anastomosing with the posterior branch of the inferior pancreatico-duodenal artery in the vicinity of the hepatopancreatic ampulla; in cases where this anastomosis is poor, ligation of the posterior superior pancreatico-duodenal artery may result in gangrene or stricture of the common bile duct.

The veins from upper part of the bile duct and the hepatic ducts, like those from the gall bladder and cystic duct, generally enter the liver directly, while those from the lower part of the bile duct enter the portal vein (Williams& Warwick, 1980).

The gall bladder:

The gall bladder lies against the under surface of the right lobe of liver. Its bulbous blind end, the fundus, projects a little beyond the sharp anterior margin of the liver and touches the parietal peritoneum of the anterior abdominal wall at the tip of the ninth costal cartilage, where the transpyloric plane crosses the right costal margin, at the lateral border of the right rectus abdominis muscle.

The body of the gall bladder, narrower than the fundus, passes backwards and upwards from this point towards the right end of the porta hepatis. Here it narrows into the neck, from which the cystic duct lies against the porta hepatis to join the hepatic duct between the two layers of the peritoneum that form the free edge of the lesser (gastro-hepatic) omentum. The fundus and the body of the gall bladder are firmly bound to the undersurface of the liver by connective tissue and many small cystic veins that pass from the gall bladder into the liver substance.

The peritoneum covering the liver passes smoothly over the gall bladder. Occasionally the gall bladder hangs free on a narrow "mesentery" from the under surface of the liver (floating gall bladder). The fundus of the gall bladder lies on the commencement of the transverse colon, just to the left of the hepatic flexure, while the body that lies behind it is in contact with the first part of duodenum.

The undersurface of the liver is sloping, so the neck of the gall bladder lies at a higher level than the fundus. It lies against the upper part of the free edge of the lesser (gastro-hepatic) omentum (Last, 1985).

The relaxed gall bladder measures 7-10 cm in length and 2-3 cm in width and has a capacity of 30-50 c.c.

Histologically, the gall bladder wall has four distinct layers:

(1) The mucosa of the gall bladder is formed by a single layer of tall collumnar cells that are thrown up into numerous, interlacing, tiny folds creating a honey combed- appearance of the mucosal surface. Simple tubulo alveolar, mucous secreting glands are present only in the neck while the body and fundus have none. Similar lining epithelium and glands are found throughout the major extrahepatic biliary ducts. The mucosa of the gall bladder neck is thrown into a varying number of crescentic folds forming the spiral valves of Heister. These valves do not have valvular function (Schwartz, 1984).

The mucosal columnar epithelium of the gall bladder and ducts is based upon a delicate connective tissue stroma, but there is no well developed submucosa in the gall bladder.

(2) Beneath the mucosa is a fibromuscular layer composed of smooth muscle cells and elastic fibrils. This layer provides contractility to the gall bladder.

(3) A perimuscular layer of connective tissue and elastic fibres, often sparsely infiltrated with lymphocytes, is interposed between the muscular wall and the outer wall of the gall bladder.

(4) A serous peritoneal layer covers all but the bare area of the hepatic bed.

Two common histologic variants merit mention here. These variants are so common as to constitute virtually normal details. Small duct-like structures (ducts of Luschka), lined by typical epithelial cells are often found in the perimuscular connective tissue layer. These do not communicate with the lumen but are occasionally connected with the bile ducts and are assumed to represent aberrant supernumerary ducts. As sites for inspissation of bile and stasis of bacteria and debris, they may contribute to the genesis of inflammatory diseases.

Rokitansky-Aschoff sinuses are small outpouchings of the mucosa of the gall bladder that extend into the underlying connective tissue and sometimes into the muscular layer. These obviously communicate with the lumen of the gall bladder, and are lined with typical columnar epithelium. These sinuses are occasionally found in normal and often in diseased gall-bladders. Their higher incidence in inflamed gall bladders raises the possibility that preexisting injury to the wall may predispose to their development. However, their infrequent occurance in completely normal gall bladder suggests that they may also represent a minor deviation from the norm-possibly attributable to the herniation of the mucosa through minute points of muscular weakness (Robbins, 1981).

The closeness of the lining epithelium to the muscular layer and the absence of a submucosa suggest that the muscular coat of the gall bladder