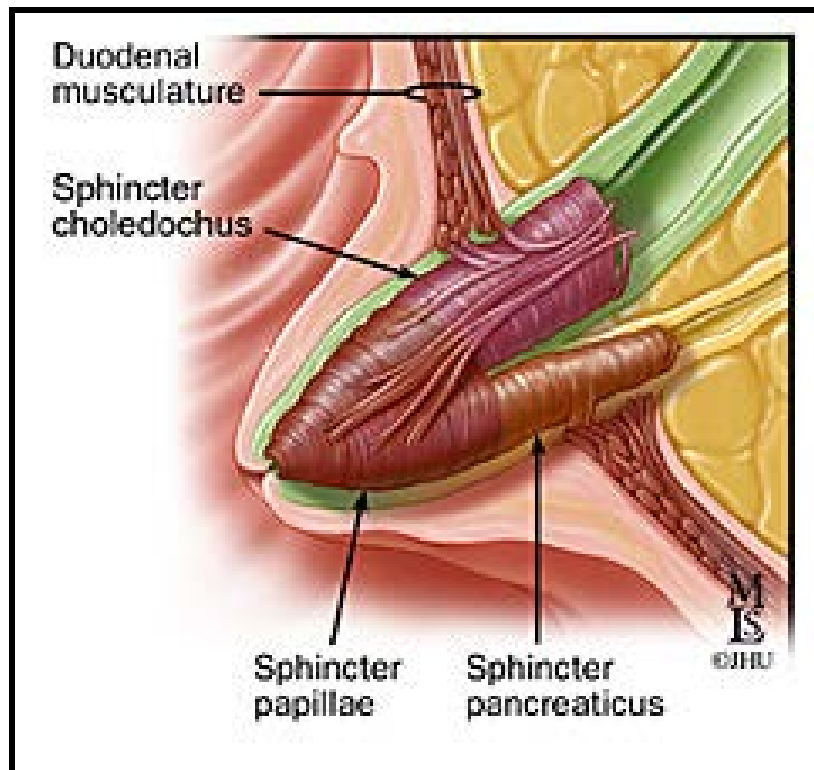


SPHINCTER OF ODDI DYSFUNCTION (SOD)

Sphincter of Oddi dysfunction refers to structural or functional disorders involving the biliary sphincter that may result in impedance of bile and pancreatic juice flow. Up to 20% of patients with continued pain after cholecystectomy and 10–20% of patients with idiopathic recurrent pancreatitis may suffer from sphincter of Oddi dysfunction. This condition is more prevalent among middle-aged women for unclear reasons

The sphincter of Oddi has three major functions: 1) regulation of bile and pancreatic flow into the duodenum, 2) diversion of hepatic bile into the gallbladder, and 3) the prevention of reflux of duodenal contents into the pancreaticobiliary tract. With the ingestion of a meal, the gallbladder contracts and there is a simultaneous decrease in the resistance in the sphincter of Oddi zone.

The sphincter of Oddi consists of circular and longitudinal smooth muscle fibers surrounding a variable length of the distal bile and pancreatic duct. There are three discrete areas of muscle thickness, or mini sphincters: the sphincter papillae, the sphincter pancreaticus, and the sphincter choledochus.



SPHINCTER OF ODDI

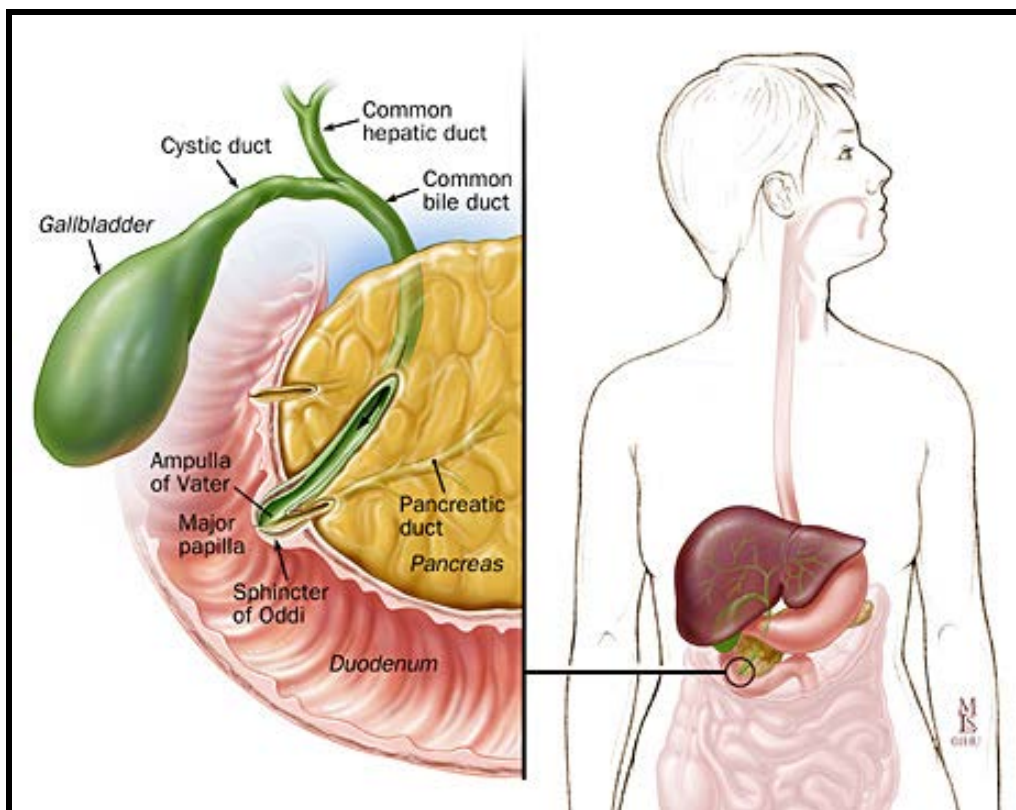
The major physiologic role of the sphincter is the regulation of the flow of bile and pancreatic juice. Cholecystokinin (CCK) and nitrates decrease the resistance offered by the sphincter. Laboratory studies observing the effects of numerous peptides, hormones, and medications on the sphincter have suggested a multifactor control mechanism for the sphincter of Oddi.

There are two types of sphincter of Oddi dysfunction: 1) papillary stenosis and 2) sphincter of Oddi dyskinesia. Papillary stenosis is a fixed anatomic narrowing of the sphincter, often due to fibrosis. Sphincter of Oddi dyskinesia refers to a variety of manometric abnormalities of the sphincter of Oddi.

SYMPTOMS OF SOD

The major presenting symptom in patients with sphincter of Oddi dysfunction is abdominal pain. The pain is characteristically sharp, postprandial, and located in the right upper quadrant or epigastrium. The pain may be associated with nausea and/or vomiting, may last for several hours, and may radiate to the back or shoulder blades. Fever, chills, and jaundice are uncommon symptoms. Patients may also present with acute recurrent pancreatitis.

The smooth circular muscle surrounding the end of the common bile duct (biliary sphincter) and main pancreatic duct (pancreatic sphincter) fuse at the level of the ampulla of Vater to become the sphincter of Oddi (Figure 3).

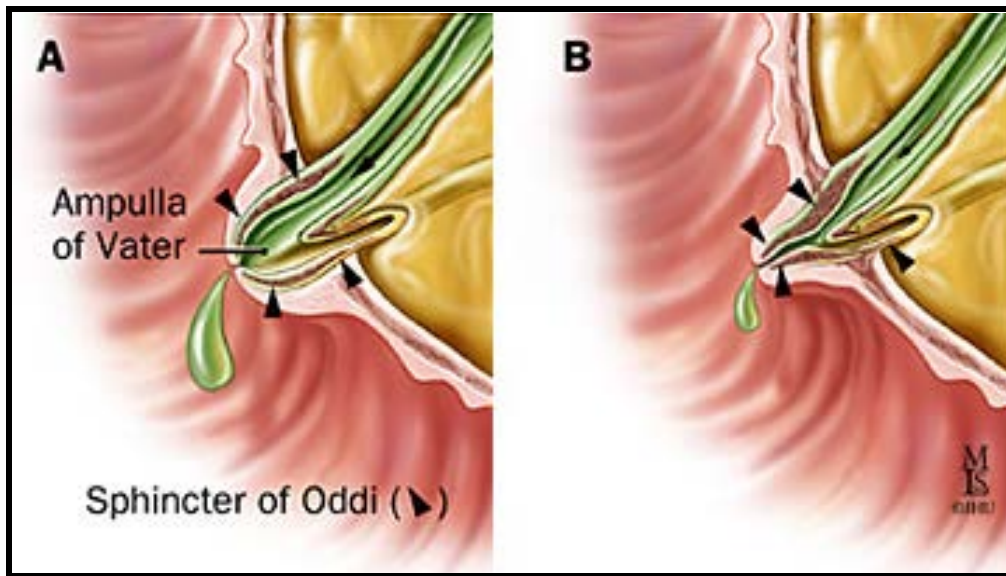


BILIARY TREE AND SPHINCTER OF ODDI

This musculature is embryologically, anatomically, and physiologically different from the surrounding smooth musculature of the duodenum . The normal appearance through

the endoscope includes the major and minor papilla. The major papilla extends 1 cm into the duodenum with an orifice diameter of 1 mm. The minor papilla is 20–30 mm proximal and medial. Its orifice is tiny and may be difficult to identify. Dysfunction of this muscle may result in unexplained abdominal pain or pancreatitis.

The sphincter of Oddi is a dynamic structure that relaxes and contracts to change the dimensions of the ampulla of Vater.



*THE SPHINCTER OF ODDI:
A) RELAXATION PHASE B) CONTRACTION PHASE*

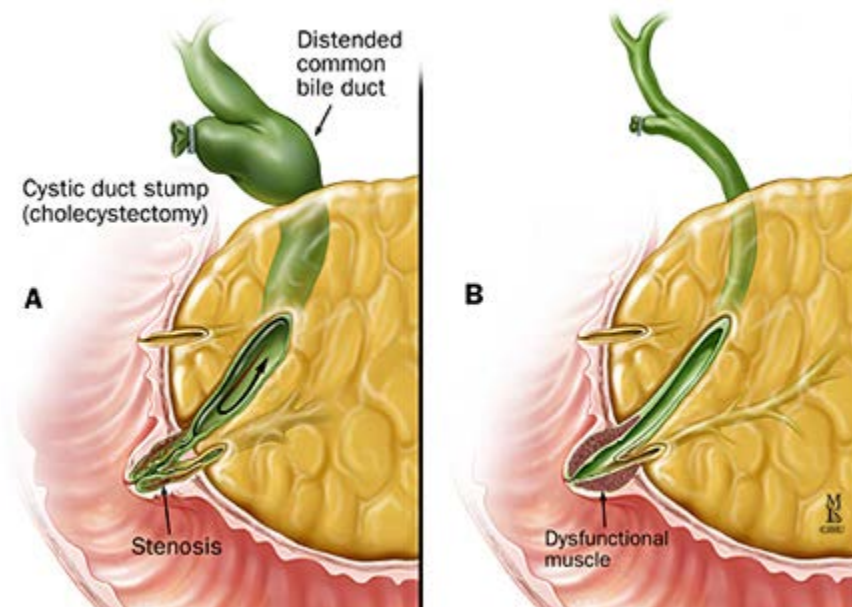
Sphincter of Oddi dysfunction is a result of anatomic and physiologic abnormalities in the distal choledochus and sphincter. A variable length of the distal choledochus and the pancreatic duct are invested with circular and longitudinal smooth muscle fibers that interdigitate with the extra-ampullary muscle fibers of the duodenal wall to form the sphincter of Oddi. Mini sphincters, or three discrete areas of muscle thickness (sphincter papillae, sphincter pancreaticus, and sphincter choledochus), comprise the sphincter of Oddi.

Upon ingestion of food, the gallbladder contracts, with a simultaneous decrease in the resistance in the sphincter of Oddi zone. The sphincter of Oddi is an independent motor unit that has a high-pressure zone in the distal choledochus approximately 5 mm Hg greater than the pressure in the distal common bile duct. This zone is approximately 5–6 mm long. The basal pressure of the sphincter is 5–15 mm Hg greater than the common bile duct pressure, and 15–30 mm Hg greater than the pressure in the duodenum. Superimposed on this resting pressure are rhythmic phasic wave contractions at an amplitude of 50–150 mm Hg and a frequency of 2–5 contractions/minute.

The major physiologic role of the biliary sphincter is regulation of bile passage, with CCK and nitrates decreasing the resistance offered by the sphincter. Laboratory studies

observing the effects of numerous peptides, hormones, and medications on the sphincter have suggested that there is a multifactor control mechanism of the sphincter of Oddi, and this mechanism is adapted to provide occlusive and propulsive influences on the flow of bile. Abnormalities in this control mechanism and/or process result in biliary colic.

Papillary stenosis and sphincter of Oddi dyskinesia are the major forms of dysfunction.



***BILIARY-TYPE PAIN RESULTS FROM DYSFUNCTION OF SPHINCTER OF ODDI:
A) STENOSIS OF THE SPHINCTER OF ODDI B) DYSFUNCTIONAL MUSCLE.***

Papillary stenosis is a structural abnormality with partial or complete narrowing of the sphincter of Oddi due to chronic inflammation and fibrosis. Overall incidence of papillary stenosis is 2–3%. Associated conditions thought to result in papillary stenosis include choledocholithiasis, pancreatitis, traumatic surgical manipulation, nonspecific inflammatory conditions, and rarely, juxtapaillary duodenal diverticula.

In sphincter of Oddi dyskinesia, functional abnormalities of the sphincter may result in biliary-type pain. Up to one-third of patients with unexplained biliary pain, often in the setting of postcholecystectomy syndrome with normal extrahepatobiliary and pancreatic systems, have manometric evidence of sphincter of Oddi dysfunction. This type of dysfunction is caused by a paradoxical response to CCK, elevated baseline pressures, or an increase in the amplitude and frequency of the phasic contractions.

POSTCHOLECYSTECTOMY SYNDROME

Postcholecystectomy syndrome is the most common syndrome associated with sphincter of Oddi dysfunction, and occurs in approximately 20% of patients who have undergone cholecystectomy surgery.

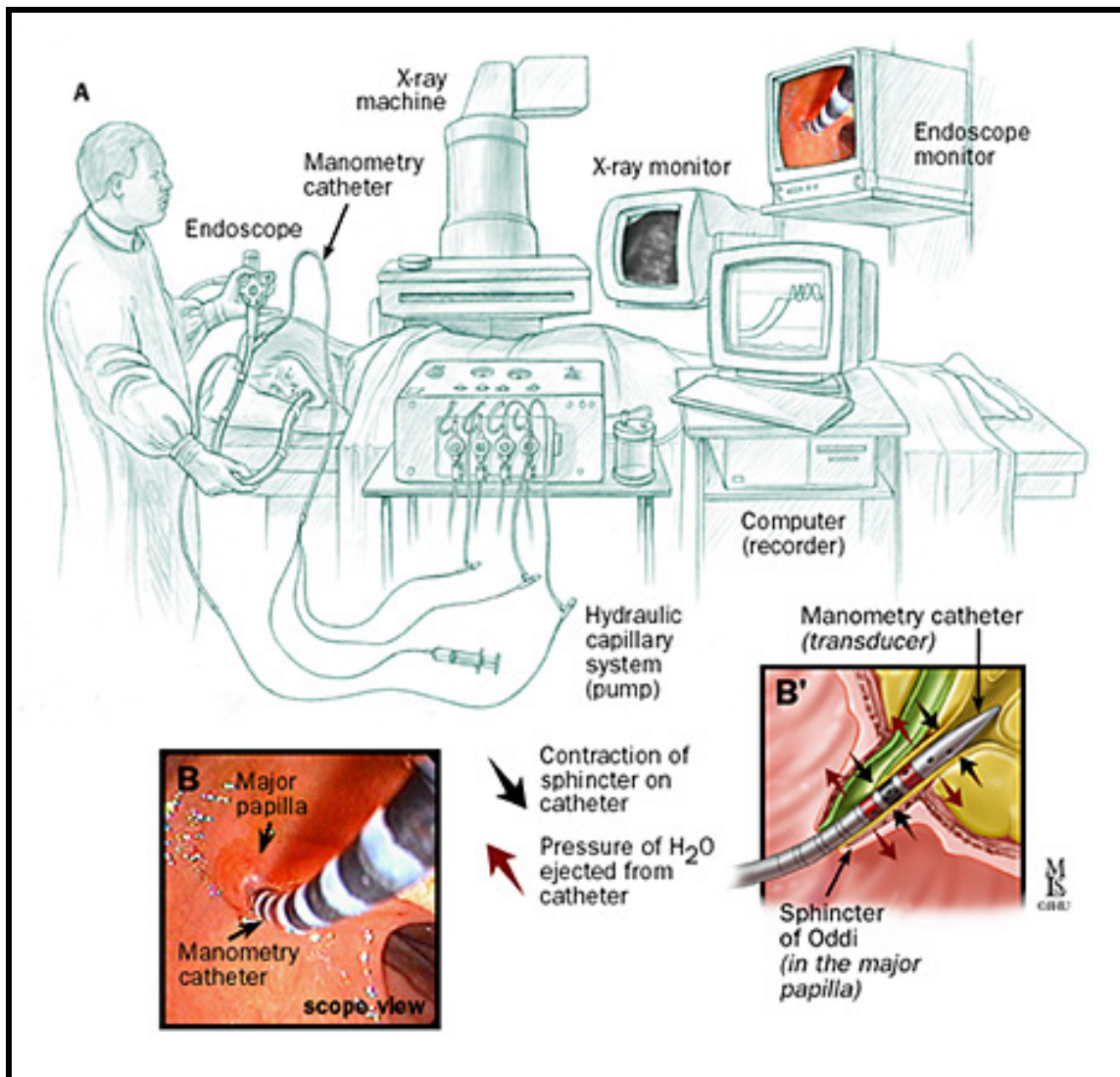
AMPULLARY OR PAPILLARY TUMORS

Tumors that involve the ampulla and/or the papillary orifice may also cause stenosis and resultant dysfunction of the sphincter of Oddi.

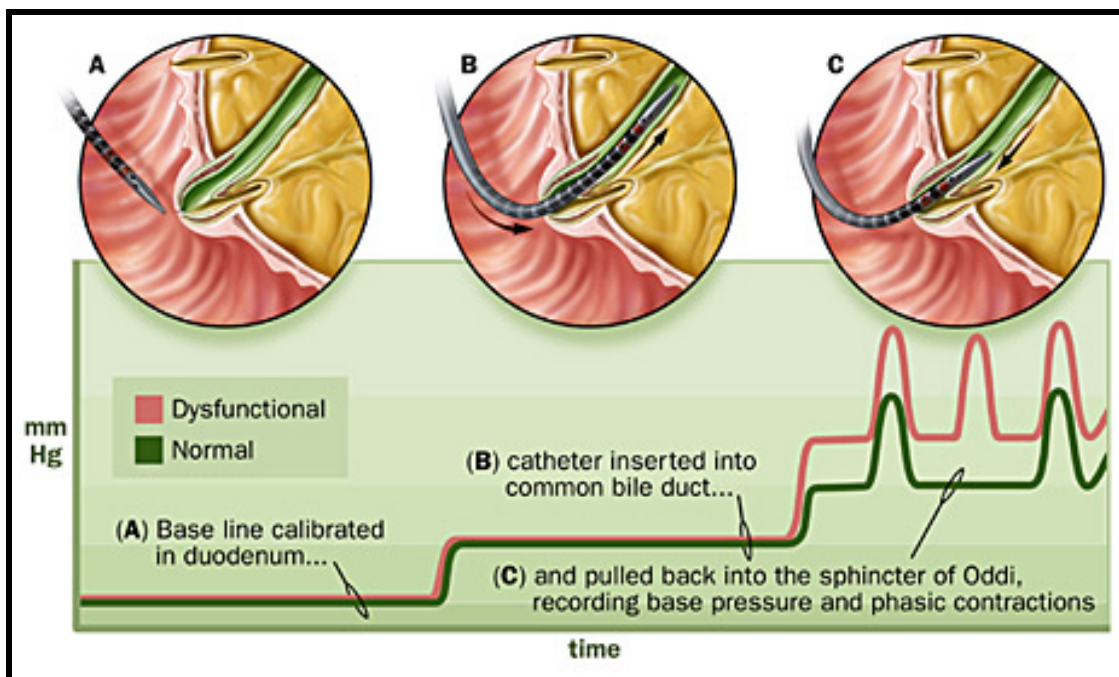
MEASUREMENT OF THE SPHINCTER OF ODDI PRESSURE

The gold standard for diagnosis is direct endoscopic manometry of the sphincter of Oddi. Retrograde cannulation of the sphincter with a water-perfused catheter records the amplitude and phasic contractions of the sphincter of Oddi. Manometric abnormalities include a basal sphincter of Oddi pressure greater than or equal to 40 mm Hg, increased amplitude of phasic contractions (greater than 240 mm Hg), increased frequency (greater than 10 contractions/min); or paradoxical response of the sphincter to CCK. Elevated basal pressure is the most reliable finding that predicts resolution of symptoms with sphincterotomy.

ERCP AND SPHINCTER OF ODDI MANOMETRY (SOM)



Manometry of the sphincter of Oddi requires a sophisticated system by which the motility pattern of the sphincter is recorded. Measurements are obtained using a special system of manometry catheters, a hydraulic capillary infusion system, and a computer software program. The fluid infusion system is of low compliance, allowing direct measurements of the sphincter of Oddi. The standard manometry catheters are triple lumen and made of polyethylene or Teflon. Each catheter lumen has an internal diameter of 0.5 mm, with three side holes at 2 mm intervals starting at 10 mm from the tip. The catheters, which are 200 cm long, have an outer diameter of 1.7 mm. The pneumatic capillary system perfuses de-ionized, bubble-free water at a pressure of 750 mm Hg and at a rate of 0.125 ml/min. Basal sphincter pressure, amplitude, frequency of contractions, and sequences of sphincter contractions may be obtained. Sphincter of Oddi dysfunction is diagnosed when the basal sphincter pressure is greater than 40 mm Hg.



ENDOSCOPIC THERAPY

Endoscopic sphincterotomy is the current standard of therapy for sphincter of Oddi dysfunction. Controlled studies document the short-term and long-term efficacy of endoscopic sphincterotomy with relatively low morbidity and mortality rates. The presence of an elevated basal sphincter pressure appears to predict good benefit from sphincter ablating procedures. In appropriate situations, benefits of endoscopic sphincterotomy are greater than 90%, with good results in long-term follow-up. Because of the high complication rate of pancreatitis after endoscopic sphincterotomy for sphincter of Oddi dysfunction, prophylactic short-term pancreatic stenting is recommended, and often yields good results.

COMPLICATIONS OF ERCP/SOM FOR SOD

Pancreatitis (inflammation of the pancreas) is the most common complication following ERCP and SOM. The type of SOD depicts the risk of developing pancreatitis. Most

patients have a mild case and are discharged after a day or two in the hospital. In rare cases, severe, life-threatening pancreatitis can develop, requiring prolonged hospitalization and possible repeat endoscopic procedures. Discuss the risks carefully with your physician before the procedure.