

Normal and disturbed motility of gallbladder and sphincter of Oddi

AJPM Smout, GP van Berge-Henegouwen, M Samsom

AJPM Smout, GP van Berge-Henegouwen, M Samsom, Department of Gastroenterology, University Hospital Utrecht, the Netherlands

Author contributions: All authors contributed equally to the work.

Original title: *China National Journal of New Gastroenterology* (1995-1997) renamed *World Journal of Gastroenterology* (1998-).

Received: November 6, 1995

Revised: January 27, 1996

Accepted: May 1, 1996

Published online: September 15, 1996

© The Author(s) 1996. Published by Baishideng Publishing Group Inc. All rights reserved.

Smout AJPM, van Berge-Henegouwen GP, Samsom M. Normal and disturbed motility of gallbladder and sphincter of Oddi. *World J Gastroenterol* 1996; 2(Suppl1): 28-29 Available from: URL: <http://www.wjgnet.com/1007-9327/full/v2/iSuppl1/28.htm> DOI: <http://dx.doi.org/10.3748/wjg.v2.iSuppl1.28>

Two smooth muscle pumps regulate the output of bile into the duodenum: The gallbladder and the sphincter of Oddi (SO)^[1]. The human liver produces 500-1000 mL of bile per day. More than half of this volume enters the gallbladder to be concentrated. Gallbladder contraction can occur both during fasting in connection with phase 2 of the interdigestive migrating motor complex (in conjunction with peak activity of serum motilin levels) and during a meal under cholecystokinin (CCK) and cholinergic stimulation^[2]. Impaired gallbladder contraction and gallbladder emptying have been linked to a number of clinical conditions with an increased incidence of gallstone disease^[3] (Table 1).

The SO is the muscular arrangement surrounding the last part of the common bile duct and pancreatic duct before it ends into the duodenum. The SO is constituted of a choledochal sphincter, a pancreatic sphincter, an ampullary sphincter and so-called intermediate fibers. The sphincteric segments of the common bile duct as well as the pancreatic duct are invariably present and therefore a complete sphincterotomy of the choledochal sphincter segment never results in total abolishment of the pancreatic SO activity^[4].

Manometry of the SO is carried out with the same equipment as used in other manometric investigations of the GI tract. This includes side-hole catheters connected to external transducers which are perfused from a pneumohydraulic capillary infusion system and connected to a computer for automatic analysis and data storage. It is important to note that the usual premedication for ERCP can not be used with the exception of benzodiazepines, as these have been shown not to interfere with the manometric recordings. Since it can take some time before a stable recording of signals is reached, only readings after stabilization should be included in the analysis.

SO manometry is performed by slowly withdrawing of the pressure recording catheter from the choledochal duct into the duodenum^[5-7]. Pressure is recorded using a triple-lumen catheter with recording orifices spaced at 2 mm intervals. A pressure rise can be seen, when entering the SO. In humans the mean pressure in the sphincter is only 4 mmHg greater than that in the common bile duct and about 15 mmHg greater than in the duodenum. Furthermore, phasic contractions can be seen superimposed on the basal pressure. These contractions occur at a rate of about 4 per minute and have an average amplitude of 100-150 mmHg. In the fasting state these phasic contractions of SO show a variable propagation. Some 60% show an antegrade peristaltic propagation, 25% are simultaneous contractions and less than 15% have a retrograde peristaltic movement. Following administration of CCK or a CCK analogue a direct inhibition of SO activity is usually recorded.

SO manometry carries a significant risk of acute pancreatitis^[8]. The incidence of acute pancreatitis varies between 6% and 20%, dependent of the criteria used. Because the complication of pancreatitis is probably due to increased pressure in the pancreatic duct caused by the catheter and the water perfusion system, it is important to stay away as much as possible from the pancreatic duct during the procedure. For this reason a special manometry catheter with separate perfusion and aspiration ports was developed. With this manometric device overpressure by water perfusion can be prevented and the complication is reduced.

Because of the fear of complications a number of other methods for patients with suspected SO dysfunction have been employed. These are cholescintigraphy with HIDA and ultrasound examination^[6]. Cholescintigraphic studies have shown an satisfactory correlation with manometry if one takes the hepatic hilus-duodenum transit as criterium. However, to date no series have proven these methods to be of value in predicting symptomatic benefit after sphincterotomy (vide infra).

SO dyskinesia or dysfunction, also called "biliary dyskinesia"^[9], is a term used to characterize an abnormality of phasic and tonic SO contractility which may be manifested clinically by biliary and/or pancreatic disorders without the evidence of gallstones. The clinical syndrome describes typically patients with postcholecystectomy pain without organic substrate and without any evidence of chronic pancreatitis. It is possible that several patients undergoing cholecystectomy for the presence of gallstones rather have SO dysfunction prior to surgery.

According to Hogan and Geenen patients with typical "non-organic" biliary pain can be divided in three subgroups. Group I includes patients with biliary pain, liver enzyme values greater than 2 times the upper limit of normal documented on 2 or more occasions, delayed contrast drainage time from the choledochal duct of more than 45 min and a dilated choledochal bile duct (> 12 mm) as seen during ERCP^[10]. Group II patients have biliary pain and one or two of the previously mentioned criteria. Group III comprises patients with biliary pain only i.e. without any of the abnormalities

Table 1 Clinical conditions with increased incidence of gallstones and abnormal gallbladder emptying (stasis)

Cholesterol gallstone disease
Use of sex hormones, pregnancy
Use of octreotide, somatostatinoma
Prolonged fasting
Gastric bypass surgery for obesity
Total parenteral nutrition
Truncal vagotomy
Diabetes mellitus
Spinal cord injury

as mentioned for group I or II. SO dysmotility occurs in almost all patients in group I, in about 50% of group II and in 25%-30% of group III patients.

Manometric abnormalities of the SO may comprise all measurable parameters. The most important being increased baseline pressure, increased phasic contraction amplitude, dyscoordination of phasic contraction propagation, tachy-oddia and a paradoxical response to intravenous CCK administration. Research from many centers has shown that the most important and discriminating criterion is an elevated SO basal pressure above 40 mmHg. Other less important criteria for abnormal SO functions are: Amplitude of phasic contractions > 250 mmHg, dyscoordination and/or absence of inhibition of SO activity after CCK injection^[11].

Response to CCK can also be used in the differential diagnosis of biliary-like abdominal pain. Recently an abnormal response to CCK with failure of complete inhibition of phasic contractions was demonstrated in 50% of patients with the irritable bowel syndrome and previous cholecystectomy. These patients might constitute a subset of those with sphincter of Oddi dyskinesia implying that the entity of SO dyskinesia is likely to be a heterogeneous group of disorders, one of which may include the irritable bowel syndrome^[11].

With respect to tachy-oddia it is important to differentiate this phenomenon from the normal phase 3 activity during the regular migrating motoric complex of gastrointestinal motility. Tachy-oddia of the SO probably is a physiologic event during the passage of a normal phase 3.

Definitive proof of SO abnormality as the cause of the biliary pain was provided by a randomized study comparing sphincterotomy with a sham procedure. In this study it was shown that sphincterotomy was of clear clinical benefit only in those patients who had an elevated basal SO pressure. Recently this was confirmed in a retrospective survey for the use of the SO manometry in the UK. Therefore, it can be recommended that patients with biliary type pain without organic substrate but with increased SO baseline pressure should undergo sphincterotomy^[12].

They are the most likely candidates to have a predictable symptomatic improvement of their biliary pain after this procedure. The practical value of drugs in the treatment of SO dyskinesia is limited. When CCK produces a paradoxical increased basal pressure or increased phasic activity in association with biliary pain, a CCK-antagonist potentially could be of value, but until now no CCK-antagonists have been approved for therapeutic use in humans. Another possibility could be the use of Botulinum toxin, but this has only been used in experimental animals until now.

REFERENCES

- 1 **Portincasa P**, Di Ciaula A, Baldassarre G. Gallbladder motor function in gallstone patients: sonographic and *in vitro* studies on the role of gallstones, smooth muscle function and gallbladder wall inflammation. *J Hepatol* 1994; **2-1**: 430-440
- 2 **Stolk MF**, van Erpecum KJ, Smout AJ, Akkermans LM, Jansen JB, Lamers CB, Peeters TL, vanBerge-Henegouwen GP. Motor cycles with phase III in antrum are associated with high motilin levels and prolonged gallbladder emptying. *Am J Physiol* 1993; **264**: G596-G600 [PMID: 8476046]
- 3 **Stolk MF**, van Erpecum KJ, Renooij W, Portincasa P, van de Heijning BJ, vanBerge-Henegouwen GP. Gallbladder emptying *in vivo*, bile composition, and nucleation of cholesterol crystals in patients with cholesterol gallstones. *Gastroenterology* 1995; **108**: 1882-1888 [PMID: 7768394 DOI: 10.1016/0016-5085(95)90153-1]
- 4 **Xu QW**, Shaffer EA. Cisapride improves gallbladder contractility and bile lipid composition in an animal model of gallstone disease. *Gastroenterology* 1993; **105**: 1184-1191 [PMID: 8405865]
- 5 **Geenen JE**, Hogan WJ, Dodds WJ, Stewart ET, Arndorfer RC. Intraluminal pressure recording from the human sphincter of Oddi. *Gastroenterology* 1980; **78**: 317-324 [PMID: 7350055]
- 6 **Toouli J**, Geenen JE, Hogan WJ, Dodds WJ, Arndorfer RC. Sphincter of Oddi motor activity: a comparison between patients with common bile duct stones and controls. *Gastroenterology* 1982; **82**: 111-117 [PMID: 7053322]
- 7 **Rolny P**, Anderberg B, Ihse I, Lindström E, Olaison G, Arvill A. Pancreatitis after sphincter of Oddi manometry. *Gut* 1990; **31**: 821-824 [PMID: 2370018 DOI: 10.1136/gut.31.7.821]
- 8 **Sherman S**, Troiano FP, Hawes RH, Lehman GA. Sphincter of Oddi manometry: decreased risk of clinical pancreatitis with use of a modified aspirating catheter. *Gastrointest Endosc* 1990; **36**: 462-466 [PMID: 1699837 DOI: 10.1016/S0016-5107(90)71115-7]
- 9 **Hogan WJ**, Geenen JE. Biliary dyskinesia. *Endoscopy* 1988; **20 Suppl 1**: 179-183 [PMID: 3168947 DOI: 10.1055/s-2007-1018172]
- 10 **Geenen JE**, Hogan WJ, Dodds WJ, Toouli J, Venu RP. The efficacy of endoscopic sphincterotomy after cholecystectomy in patients with sphincter-of-Oddi dysfunction. *N Engl J Med* 1989; **320**: 82-87 [PMID: 2643038 DOI: 10.1056/NEJM198901123200203]
- 11 **Evans PR**, Dowsett JF, Bak YT, Chan YK, Kellow JE. Abnormal sphincter of Oddi response to cholecystokinin in postcholecystectomy syndrome patients with irritable bowel syndrome. The irritable sphincter. *Dig Dis Sci* 1995; **40**: 1149-1156 [PMID: 7729279]
- 12 **Lee SK**, Kim MH, Seo DW, Yoo BM, Lee MH, Myung SJ, Min YI. Frequency of phasic wave contraction is variable during long-term sphincter of Oddi manometry. *Am J Gastroenterol* 1996; **91**: 2395-2398 [PMID: 8931424]

E- Editor: Liu WX



Published by **Baishideng Publishing Group Inc**
8226 Regency Drive, Pleasanton, CA 94588, USA
Telephone: +1-925-223-8242
Fax: +1-925-223-8243
E-mail: bpgoffice@wjgnet.com
Help Desk: <http://www.wjgnet.com/esps/helpdesk.aspx>
<http://www.wjgnet.com>

