Truncal Vagotomy for Peptic Pyloric Stenosis and Assessment of Completeness by Acid Tests.

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Background: Several types of operations are used for Peptic pyloric stenosis (PPS) which includes Vagotomy with antrectomy or drainage procedures. This study was done primarily to analyze the completeness of Truncal vagotomy (TV) by gastric acid secretion tests. The secondary analyses included demographic, clinical profile and out come of the operation.
Methods: From December 27/2004 to June 26/2006, 32 consecutive patients, aged 10 to 65 years underwent trans-abdominal (TV) and Posterior Gastrojejunostomy for PPS at Glen C. Olsen memorial hospital. TV without mobilizing and encircling the esophagus. Prospective longitudinal case serial analysis was done to assess the completeness of TV. Outcome measures used for assessment were the pre-operative basal acid output (BAO), Post-operative BAO, Post-operative sham feeding acid out put (SAO) and other relevant clinical characteristics.
Results: After surgery, the average pre-operative BAO had decreased from 6.07+/-2.7mmol/hour to 0.42+/-0.29mmol/hour. The BAO was decreased by 91.3%. Mean peak acid response after TV to SAO was 0.83+/- 0.45mmol/hour. The difference between the peak 15minutes out put of SAO and lowest 15 minutes out put of post-operative BAO did not exceed 0.6mmol in 30/32 patients. This shows that TV was complete in 93.7%. There was no operative mortality and clinically significant post-operative complication developed in only three patients.
Conclusion: Trans-abdominal TV done without mobilizing and encircling the esophagus was found safe and effective means of reducing acid secretion for patients with long standing peptic pyloric stenosis.

Introduction

Peptic pyloric stenosis is a world wide event seen in all age and sex[1]. It is a frequent reason for surgical admission to our hospital accounting for 7.3% of major surgeries. Similar trend was also seen in other developing countries.[2-7] It is one of the major complication of duodenal ulcer reported to occur in 6- 8%.[8] PPS requires dual operation which includes relieving obstruction and controlling peptic ulcer disease[9]. These are best achieved by Vagotomy with antrectomy, TV with Gastrojejunostomy, or Billroth II Gastrectomy. Vagotomy combined with antrectomy is regarded as the most effective curative operation, because the subsequent recurrent ulcers are < 1%[10]. Although this operation is effective, the difficulty in dissection of the obstruction segment of the pyloric channel, the difficulty in the closure of the duodenal stump, the longer operation time, and the larger extent of operation usually lead to a higher postoperative complications.[11]

Laparoscopic assisted posterior vagotomy with seromyotomy can be done with good results, thou it is technically demanding and requires more expertise and resources.[12] Selective or highly selective vagotomy alone is not appropriate in the setting of pyloric stenosis as it dose not relieve the obstruction[13]. Pyloroplasty is not advisable in case of severe inflammation of the pyloroduodenal area[13].Endoscopic balloon dilatation has been proposed as an alternative to surgical treatment. However, 50% of patients treated with balloon dilatation remained with recurrent ulceration or outlet obstruction at 3 years.[14-15]Even though ulcer recurrence after TV-Gastrojejunostomy is about 10%, [16] it still has a role in the treatment of PPS. It is technically simple and easy to perform with few side effects. The main objective of TV is the completeness of vagal denervation which is the determining factor for its long term out come. For achieving complete denervation of the vagi, proper knowledge of its anatomy is essential. In a study of vagal structures using 100 cadavers, in 88% anterior and posterior vagus were found without split, in 7% there were four divisions, and in 5% more than four divisions of both trunks seen at the level of the hiatus.[17] Therefore, during trans abdominal TV, it is required to properly identify both Trunks and divide them properly. Because of this routine anatomic

land marks, a complete division of both vagus can be achieved without encircling and mobilizing the esophagus.

To the author's best knowledge, for cases of PPS, there has been no previous study published on the acid secretion test after TV done without encircling and mobilizing the esophagus. This study is therefore aimed to highlight the role of TV done without encircling and mobilizing the esophagus for treatment of PPS which can be used as an alternative technique to the standard method.

Patients and Methods

A prospective hospital based longitudinal case series analysis of all patients admitted and operated for PPS from Dec 27/2004 – June 26/2006 at Glenn C. Olsen memorial primary general hospital was done. All patients were initially evaluated by history, physical examination with relevant laboratory and imaging studies. Diagnosis of pyloric stenosis was made based on clinical finding of non bilious projectile vomiting, audible suction splash 3-4 hours after meal and barium study demonstrating dilated stomach with narrowed gastric outlet with retention of 50% or more of ingested barium after 4 hours. All patients with possible diagnosis of pyloric stenosis were admitted and treated with fluid & electrolyte replacement and decompression of the stomach with Naso-gastric tube for variable number of days. Parentral nutrition was not available for use. Lavage of the stomach with normal saline was done until the effluent was clear an hour before surgery and prophylactic antibiotics was given 30 minutes before surgery. Informed consent was obtained from all patients or their guardian before surgery and acid secretary test.

Operative approach

All procedures were carried out by a single surgeon who only had two years of independent experience as a general surgeon. In all patients the approach was similar where patients were placed in reverse Trendelenberg position and abdomen was opened through long upper midline incision extending from the base of xiphoid process to the umbilicus. A large self retaining retractor was used in separating the abdominal wound at its center. Kelly retractor with pack protecting the liver used to expose the esophago-gastric junction. Abdominal viscera were inspected systematically. The presence of ulceration, fibrosis and /or cicatrisation was confirmed by careful inspection of the first part of duodenum and pylorus. Then the peritoneum overlying the distal esophagus, as close to the level of the esophageal hiatus as possible was incised transversely and ext ended medially to the lesser sac. Using a Mickulicz pad the assistant places a gentle down ward traction on the greater curvature of the stomach, there by placing traction on the gastro-esophageal junction and lower esophagus. In the course of this maneuver the nerve trunks usually was palpated as a taut cord.

The anterior vagus was first identified usually adherent to the anterior wall of the esophagus and separated from it using long dissector artery forceps and divided high in the hiatus. The rest of the anterior esophagus will then be palpated for possible additional nerve fibers and if identified it will be divided. Once division of the anterior vagi is completed, index finger will then gently passed to the medial side of the esophagus in to the areolar tissue, in the mean time the assistance will continue on gentle down ward traction of the greater curvature which will enable the posterior vagus to 'bow string' and makes it easier to be identified and divided. Following this, retro-colic gastro-jejunostomy was done for drainage purpose. Finally mid-line incisions were closed in layers. Patients were allowed to fluid diet a day after removal of naso-gastric tube and were encouraged to ambulate on the next post operative day. They were discharged when acceptable condition achieved and oral intake was well tolerated.

Acid secretion test

Before Truncal vagotomy

Basal acid output (BAO) was measured after an overnight fast on the day of surgery. Patients were sited on semi-recumbent position and 18 Fr nasogastric tube was positioned under fluoroscopic

guidance with its tip in the antrum. All residual gastric contents was aspirated and discarded. Then gastric contents were collected in 15 min period four times in 1 hour using intermittent suction.

After Truncal Vagotomy

Post–operative tests were performed between 7^{th}-21^{st} postoperative days and BAO was measured first followed by sham feeding stimulated acid out put (SAO). During sham feeding procedure patients were given a meal which was chewed and spat out in to basin every 15 minutes period, and collected four times in 1 hour. Food was cooked in separate area so that they could not see or smell it before the test began. In both BAO and SAO, gastric juice was collected in 15 minutes period and the volume was measured. The PH was measured using a glass electrode PH meter called PH-315 I set. (WTN 82362 WEILHEIM conforms to UL STD 3101, certified CSA standard C-22.2 No. 1010). Given the PH, the hydrogen ion concentration was calculated using electronic calculator with antilogarithmic functions ($[H^+] = 10^{-PH}$) [18-19].Finally, acid secretion in millmoles per 15 min is calculated by multiplying the acidity (mmol/l) times the volume (liter/15 min). The BAO and SAO per hour were also determined by adding the four consecutive 15 minutes acid out put and comparison of pre and post operative BAO was made.

Test interpretation

An acid secretary response of SAO not exceeding BAO by more than 0.6 mmol per 15 minutes collection period was used as a criterion for establishing the completeness of vagotomy.[20-21]

Statistical analysis

Structured formats were used to collect all relevant information and statistical analysis was done using Statistical Package for Social Science (SPSS) version 15.0 for Windows (SPSS Inc., Chicago, IL, USA). Data are presented as mean or median (range) evaluated using analysis of variance for repeated measures.

Results

For all patients, TV with posterior gastro-jejunostomy was done with the method described above and both vagus were identified and transected. Analysis of the acid secretion showed an average pre-operative BAO of 6.07+/-2.71mmol/hour (range 2.9 to 12.55). After TV, it decreased to 0.42+/-0.29mmol/hour (range 0.003 to 1.394). Comparison of the pre and post vagotomy BAO showed a mean reduction of 91.3% (range 66.3%-99.9%). (Fig 1)

The mean peak acid response after vagotomy to sham feeding was 0.83+/- 0.45mmol/hour (range 0.19 to 2.43), compared with BAO after vagotomy which was 0.42+/-0.29 mmol/hour (range 0.003 – 1.39). Figure two shows the difference between the highest post vagotomy BAO and the lowest SAO recorded in 15 minutes for each patient. The average increase after SAO, the peak 15 minutes out put minus the lowest basal 15 minutes out put value , did not exceed 0.6 mmol per 15minutes in 30/32 patients. Since only two patients had an acid response to SAO which exceeds the lowest basal level by more than 0.6mmol/15 minutes, it can be considered that vagotomy was complete in 93.7% of patients. Patient number 9 and 24 were found to have a difference of 0.815mmol and 1.054mmol Per 15 minute records. There for considering that there is a possibility of incompleteness, they were given H.pylori eradication treatment during the subsequent follow up period.

The clinical presentation and out come measure showed that there was 21/32 male and 11/32 female patients (M: F→1.9:1). Mean age at presentation was 36+/-15.2 years (range 10 to 65 years). The highest age specific prevalence was between 25 to 35 years accounted for 8/32. The mean duration of vomiting was 20.4+/- 17.4 months (range 2 to 60 months). It was only 10/32 patient's look for medical advice with in 6 months of onset of vomiting. No patient used NSAIDs on regular base, 11/32 is social alcohol drinkers, and 7/32 was smokers and 20/32 chew Khat daily. Khat is leaves which contain cathinone, an amphetamine like stimulant used for excitement.

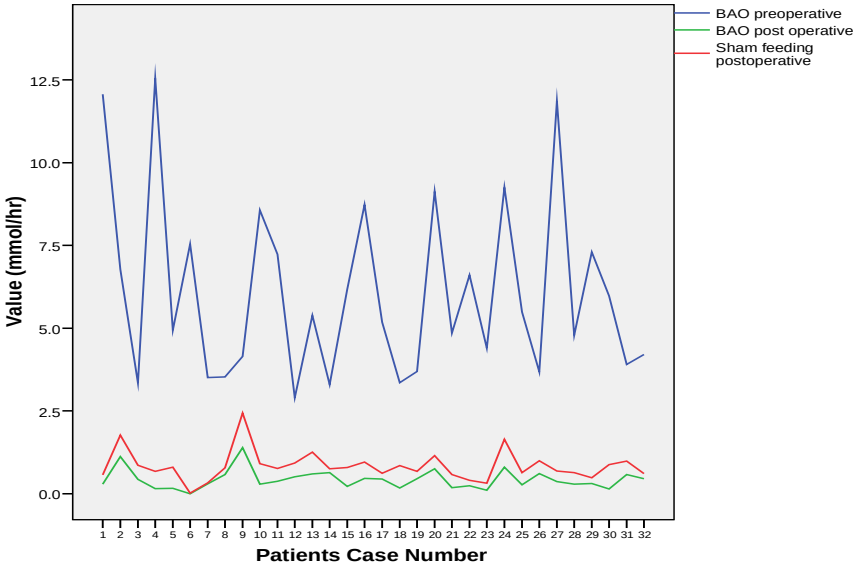

Figure 1. The preoperative BAO, post operative BAO and SAO of 32 patients with PPS.

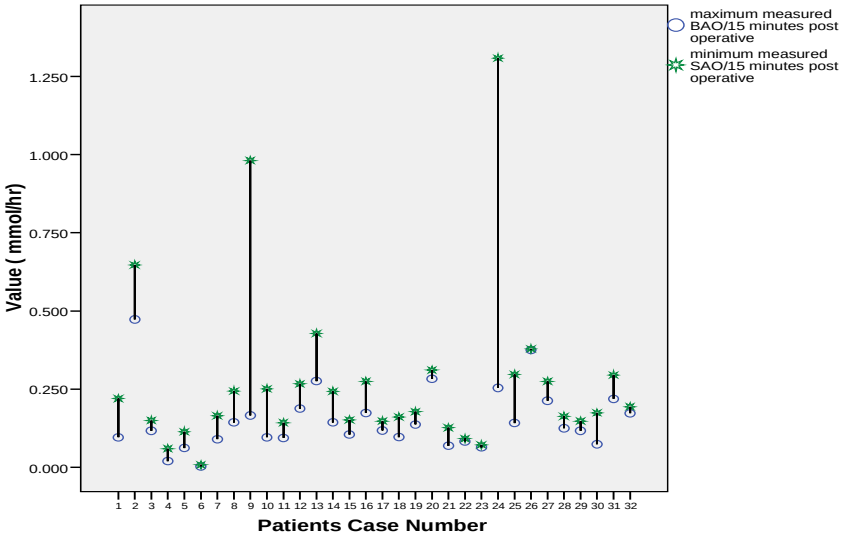

Figure 2. The difference between the highest and the lowest BAO and SAO Recorded in 15 minutes of 32 patients who under go TV for PPS

During admission, due to prolonged episodes of vomiting, 10/32 patients present with signs of dehydration and hypovolemic shock. Pyloric stenosis was the initial manifestation of peptic ulcer disease in 21/32patinets. The rest, 11/32, were previously treated for PUD with different anti-ulcer medications but not H.pylori eradication treatment. In 31/32 patients cicatrisation and fibrosis of the duodeno-pyloric area with or with out adhesion and proximal big dilated stomach was found. One patient had pyloric stenosis assisted with anterior perforation of the duodenum with minimal localized peritonitis. One patient had pyloric obstruction from tuberculosis lymphadenitis and inflammatory edema which was treated with drugs alone and responded well. He was excluded from the final

analysis. The duration of surgery was 51+/- 13.8min (range 40 to 90 minutes) and the estimated blood loss was 156.8+/- 56.4ml (range 100 to 500ml). The average hospital stay was 10.3+/- 3.4 days (range 7 to 24 days). (Table 1)

There was no operative mortality and early post operative complication was seen in three patients. One patient had transient symptoms of delayed gastric emptying who responded well with metclopromide, continuous stomach suction and adequate fluid electrolyte replacement. He was allowed to take fluid diet after 10th post-operative day. The other two had wound infection and pneumonia.

Table 1. Descriptive Statistics of age, hospital stay, duration of vomiting, resuscitation, stomach decompression, blood loss, surgery time and different acid secretary tests.

	Minimum	Maximum	Mean	Std. Deviation
Age	10	65	36	**15.2**
Hospital Stay	7	24	10.3	**3.4**
Duration of vomiting(month)	2	60	20.4	**17.4**
NGT decompression (days)	1	3	1.28	**0.52**
Resuscitation (Days)	0	10	2.84	**2.03**
Blood loss (ml)	100	500	156.8	**56.4**
Duration of Surgery(min)	40	90	51	**13.8**
Preoperative BAO(mmol/hour)	2.9	12.55	6.07	**2.71**
Postoperative BAO(mmol/hour)	0.003	1.394	0.42	**0.29**
Postoperative SAO(mmol/hour)	0.19	2.43	0.83	**0.45**
Mean reduction of BAO after surgery (%)	**66.3**	**99.9**	**91.3**	**7.1**

Discussion

The results show that TV done without encircling and mobilizing the esophagus has safely and effectively reduces the acid secretion similar to other standard methods[1-10].It also had shorter operative time and similar or less complication in the immediate postoperative period. Dragstedt L[22] had found that basal vagal activity had an important driving force for the spontaneous gastric acid secretion and Johnston[21] found that basal acid secretion had markedly reduced after proximal gastric vagotomy, a finding which was similarly observed in this study in which BAO reduced by an average of 93.3%. Richard C.[23] had studied the effect on basal, sham feeding and pentagastrin-stimulated acid secretion (PAO) after transthoracic vagotomy done for 16 patients with postoperative recurrent ulcer. He found that the BAO has decreased by 91.2% and the SAO and PAO decreased by 98+/-1% and 73+/-8 % respectively. Gastric acid secretion test done on thirty-one patients, aged 40 to 76 years (mean 53 years), who were treated by conventional and 10 by a laparoscopic stapling-modified Taylor procedure for chronic duodenal ulcer showed that the basal and peak acid output were 1.5+/-0.6 mmol /hour and 12.2+/-6.4 mmol /hour, respectively.[24] Another review conducted after highly selective vagotomy and truncal vagotomy and pyloroplasty performed for peptic ulcer disease found a reduction of basal acid output by 80% and maximal acid output by 50% to 60% in both conditions[25].

Mean operative time of this procedure was shorter than the other procedures[22-26].This could be due to the fact that TV was done without mobilizing and encircling the esophagus. Furthermore, with increasing time, expertise will develop and operating time reduces. In this study, patients were discharged on the tenth postoperative day (average). This is relatively longer than other studies .[24-25]This happened because a significant number of patients stayed long before surgery for they need to be resuscitated before operation. Due to long duration of vomiting, 10/32 of our patients presented with signs of dehydration and hypovolemic shock. Other studies done by Berhanu K[2] and Duglas etal

[32] reported 4/63 (6.3%) and 22% respectively. The incidence of post-operative complication we encountered is relatively low. We have seen only 1/32 (3.1%) patient who had developed gastric-atony. Similarly low incidence of atony after vagotomy was also reported from both developing[4-7] and developed countries.[9-13]

Identification of H. Pylri infection as a cause of peptic ulcer has influenced not only treatment strategy for peptic ulcer disease but also types of surgeries for peptic ulcer complications. In unpublished data found in the editorial by Chung and Li[33], 50% of patients with pyloric stenosis in the Department of Surgery of the Chinese University of Hong Kong were infected with H.Pylori. One author report reversal of PPS after eradication of H.Pylori infection .[34] With this observation he suggests that oral eradication of H.Pylori might be indicated as a first-line treatment in patients with PPS followed by endoscopic dilatation before surgery[15,34]. In our institute all patients with PPS are not initially treated with medications to eradicate H Pylori. Besides, endoscopic balloon dilatation is not available. Surgery is considered right away because most of our patients seek medical advice late in the course of the illness. In the future, the association between PPS and H. Pylori eradication treatment requires further investigation.

Conclusion

- Although the number of patients studied was small, the short duration of follow up and the lack of comparable similar studies are some of the limitations. The result showed that truncal vagotomy done without encircling and mobilizing the esophagus safely and effectively reduces the acid secretion similar to other standard methods.
- The procedure is technically simple and has short learning curve. It may be beneficial for less qualified general surgeon or even general practitioners with some experience in bowel surgery. It also helps to minimize complications associated with mobilizing the esophagus like bleeding, esophageal perforation, disruption of the gastro-esophageal junction and spleen injury.[35]
- It could be used as alternative method specially when technical consideration make dissection of the esophagus dangerous or associated with systemic illness precludes longer duration of surgery. In resource limited hospital like ours, patients with peptic pyloric stenosis can benefit from this type of procedure.

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