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Editorial

The association between higher volume and better outcome for pancreatoduodenectomy

Few elective surgical procedures are associated with higher operative risks than pancreatoduodenectomy. In the past, the operation was burdened by perioperative mortality rates exceeding 20% and a considerably higher morbidity rate [1–3]. In a patient series collected between 1977 and 1986 in the West Midlands, UK, Bramhall and colleagues [4] found a 30-day mortality rate of 28%, and a recent survey by the Commission on Cancer in USA demonstrated that mortality rates higher than 10% remain common [5]. However, in later years several experienced centres have reported markedly improved results of less than 5% [6–9]. In a nationwide study from the Netherlands, 46% of the pancreatoduodenectomies were performed in hospitals doing fewer than five operations per year and with a hospital mortality rate of 16%. In centres doing more than 25 resections per year, the corresponding figure was 1.5% [10].

Although if we and other authors [7, 11] previously pointed to a possible relationship between the hospital's/surgeon's experience of pancreatoduodenectomy and the outcome of operation, it was not until the 1990s that this matter was more closely explored. In 1995, Gordon and associates [12] published a retrospective study on 501 patients who underwent pancreatoduodenectomy at one of 39 hospitals in Maryland from 1988 through the first half of 1993. Hospital mortality rate (2.2% vs 13.5%), length of stay and costs were significantly less at the high-volume regional medical centre compared with all other hospitals. Lieberman and co-workers [13] studied 2233 pancreatoduodenectomies or total pancreatectomies performed in New York State from 1984 to 1991. Hospital mortality rate was 19% in hospitals where fewer than ten resections were done during the period, 12% where 10–50 resections were done, 13% where 51–80 operations were performed and 6% in hospitals doing more than 81 operations. These authors also found a higher operative mortality rate for low-volume surgeons (<9 resections; 16%) compared with high-volume surgeons (>41 resections; 5%). Glasgow and Mulvihill [14] carried out a similar study to that of Lieberman [13] when they used statewide hospital discharge records in California from 1990 to 1994. Among the 298 hospitals, 88% treated an average of two or fewer patients per year with pancreatic resection. Centres with higher volume had better profiles in mortality, cost and length of hospitalisation.

Begg and associates [15] used the Surveillance, Epidemiology and End Results (SEER) Medicare linked database to see whether hospital volume was inversely associated with 30-day mortality in 5013 patients aged 65 years or older undergoing different resectional procedures for various malignancies. Higher volume was linked with lower mortality rates for pancreatectomy, oesophagectomy, liver resection and pelvic exenteration, but not for pneumonectomy. There was no evidence that tumour stage varied according to hospital volume. Birkmeyer and colleagues [16] performed a national cohort study of 7229 Medicare patients over 65 years of age undergoing pancreatoduodenectomy between 1992 and 1995. Hospitals performing five to ten operations per year had higher in-hospital mortality rates than the seven hospitals doing ten to 20 operations or the three hospitals doing 20 or more procedures annually (6.2% vs 2.5% vs 1.7%, $p<0.01$).

Simunovic and co-workers [17] reported a population-based retrospective analysis of 842 pancreatic resections for cancer performed in Ontario from 1988/89 to 1994/95. This study differed from the above-mentioned US studies by representing a publicly financed health care system. Again, case fatality was associated with hospital volume, being 14.4%, 12.8% and 3.4%, respectively, for low-, medium- and high-volume hospitals. Length of stay was consistently lower in the high-volume group.

The first European study evaluating the higher volume–better outcome concept was recently published by Gouma and his colleagues [18] from the Netherlands, where the medical registry included 1126 partial pancreatoduodenectomy patients between January 1994 and December 1998. The annual hospital death rates ranged from 13.6% to 20% in small-volume hospitals (<5

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operations per year) and from 0% to 2.9% in high-volume hospitals (>25 operations per year).

Although these reports are all retrospective, rely on registries with dated data, rarely have predefined hypotheses and may have publication and self-interest biases, most of them support a volume–outcome relationship in the initial treatment with curative intent of patients with pancreatic cancer. The problem of case mix was analysed in three studies [14,15,19]. No difference in comorbidity, stage of disease or age was found for high- and low-volume hospitals. It is important to recognise that within the low- and medium-volume groups, individual hospitals had widely differing mortality rates. Although some surgeons had low mortality rates even in low-volume hospitals, the influence of the surgeon's volume on outcomes (where studied) was less important than the hospital volume [13,19], emphasising the role of the multidisciplinary speciality treatment team.

In the single study by Wade and co-workers [20], a positive volume–outcome relation was not obtained. It is likely that this negative finding resulted from a lack of high-volume centres in the analysis.

Birkmeyer and associates [21] investigated the possible influence of hospital volume on late survival after pancreatoduodenectomy for cancer in patients over the age of 65. They found a higher three-year survival at high-volume hospitals (37%) than at those with medium (29%), low (26%) or very low volume (25%) ($p<0.0001$). In a National Health Service (NHS) report from the UK on patients treated at 23 hospitals [22], it was found that the risk of death among patients with pancreatic cancer treated in hospitals that dealt with one new case each week was 36% lower than for those treated in hospitals that dealt with one new case a month. These data indicate that hospital volume influences both perioperative risk and long-term survival after pancreatoduodenectomy for cancer. It may be of interest to mention that the NHS in a recent report [23] recommend that Pancreatic Cancer Teams should aim to draw patients from populations of 2–4 million.

As resection is the only way to cure a patient with pancreatic cancer, it is of the utmost importance that all patients with resectable disease are offered a safe and proper operation. This objective implies that surgeons get adequate training and that there are units with a sufficient patient load to build up broad competence to serve as training centres. We recently carried out an inquiry including 48 Swedish hospitals (unpublished). Half of them were performing pancreatoduodenectomies, and the majority did fewer than three such operations a year.

Against the above backdrop [12–19], the concentration of pancreatic resections to fewer hospitals is recommended to improve the overall outcome of the operation. However, such concentration is equally important to guarantee appropriate training of future pancreatic surgeons. A third reason is to pave the way for clinical research by building up sufficiently large patient volumes.

Data are, thus, accumulating that reasonable hospital volume is a plausible predictor of outcome after pancreatoduodenectomy for cancer. Even if the skill of the individual surgeon is important, it seems to be even more crucial that the multidisciplinary treatment team of surgeons, radiologists, endoscopists, anaesthetists, pathologists, radiotherapists, oncologists and specialised nurses develop substantial experience in the management of the patient with pancreatic cancer. It is becoming more and more difficult for general surgeons to defend their preserves and to persist in undertaking pancreatoduodenectomy once in a while. It is high time for us to pay regard to the higher volume–better outcome association for this particular operation.

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References

1 Mongé JJ, Judd ES, Gage RP. Radical pancreaticoduodenectomy: A 22-year experience with the complications, mortality rate, and survival rate. *Ann Surg* 1965;**160**:711–16.
2 Lansing PB, Blalock JB, Ochsner JL. Pancreaticoduodenectomy: a retrospective review. 1949–1969. *Ann Surg* 1972;**38**: 79–86.
3 Gilsdorf RB, Spanos P. Factors influencing morbidity and mortality in pancreaticoduodenecomy. *Ann Surg* 1973;**177**: 332–7.
4 Bramhall SR, Allum WH, Jonas AG, Allwood A, Cummins C. Neoptolomos JP. Treatment and survival in 13560 patients with pancreatic cancer, and incidence of the disease, in the West Midlands; an epidemiological study. *Br J Surg* 1995; **82**:111–15.
5 Janes RH, Niederhuber JE, Chmiel JS, Winchester DP, Ocwieja KC. Karmell LH. National patterns of care for pancreatic cancer: results of a survey by the *Commission Cancer Ann Surg* 1996;**223**:261–72.
6 Geer RH, Brennan MF. Prognostic indicators for survival after resection of pancreatic adenocarcinoma. *Am J Surg* 1993;**165**: 68–72.

7 Pellegrini CA, Heck CF, Raper S, Way LW. An analysis of the reduced morbidity and mortality rates after pancreaticoduodenectomy. *Arch Surg* 1989;**124**:778–81.

8 Trede M, Schwall G, Saeger HD. Survival after pancreaticoduodenectomy: 118 consecutive resections without an operative mortality. *Ann Surg* 1990;**211**:447–58.

9 Ihse I, Andersson H, Andrén-Sandberg Å. Total pancreatectomy for cancer of the pancreas: Is it appropriate? *World J Surg* 1996;**20**:288–94.

10 Gouma DJ, de Wit LT, van Berge Henegouwen MI, van Gulik TM, Obertop H. Ziekenhuiservaring en ziekenhuissterfte ma partiele pancreaticoduodenectomie. *Ned Tijdschr Geneeskd* 1997;**141**:1738–41.

11 Andrén-Sandberg Å, Ihse I. Factors influencing survival after total pancreatectomy in patients with pancreatic cancer. *Ann Surg* 1983;**198**:605–10.

12 Gordon T, Burleyson GP, Tielsch JM, Cameron JL. The effects of regionalization on cost and outcome for one general high-risk surgical procedure. *Ann Surg* 1995;**221**:43–9.

13 Lieberman MD, Kilburn H, Lindsey M, Brennan MF. Relation of perioperative deaths to hospital volume among patients undergoing pancreatic resection for malignancy. *Ann Surg* 1995;**222**:638–45.

14 Glasgow RE, Mulvihill SJ. Hospital volume influences outcome in patients undergoing pancreatic resection for cancer. *West J Med* 1996;**165**:294–300.

15 Begg CB, Cramer LD, Hoskins WJ, Brennan MF. Impact of hospital volume on operative mortality for major cancer surgery. *JAMA* 1998;**280**:1747–51.

16 Birkmeyer JD, Finlayson SRG, Tosteson ANA, Sharp SM, Warshaw AL, Fisher ES. Effect on hospital volume on in-hospital mortality with pancreaticoduodenectomy. *Surgery* 1999;**125**:250–6.

17 Simunovic M, To T, Theriault M, Langer B. Relation between hospital surgical volume and outcome for pancreatic resection for neoplasm in a publicly funded health care system. *CMAJ* 1999;**160**:643–8.

18 Gouma DJ, van Geenen RCI, van Gulik TM, de Haan RJ, de Wit LT, Busch ORC, Obertop H. Rates of complications and death after pancreaticoduodenectomy: risk factors and the impact of hospital volume. *Ann Surg* 2000;**232**:786–95.

19 Sosa JS, Bowman HM, Gordon TA, Bass EB, Yeo CJ, Lillemoe KD, Pitt HA, Tielsch JM, Cameron JL. Importance of hospital volume in the overall management of pancreatic cancer. *Ann Surg* 1998;**228**:429–38.

20 Wade TP, Halaby IA, Stapleton DR, Virgo KS, Johnson FE. Population-based analysis of treatment of pancreatic cancer and Whipple resection: Department of Defense hospitals, 1989–1994. *Surgery* 1996;**120**:680–7.

21 Birkmeyer JD, Warshaw AL, Finlayson SRG, Brove R, Tosteson ANA. Relationship between hospital volume and late survival after pancreaticoduodenectomy. *Surgery* 1999;**126**:178–83.

22 Bachmann M, Alderson D, Peters T. *Survival, Clinical Practice and Costs in Patients with Pancreatic, Oesophageal and Gastric Cancers: Influences of Doctor and Hospital Volumes*. Bristol: Department of Social Medicine and Surgery, University of Bristol, 1999.

23 Management of upper gastro-intestinal cancers. *Effective Health Care* 2000;**6**:1–16. NHS Centre for Reviews and Dissemination.