



Impact on patient outcomes after regionalization of pancreatic surgery

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Pancreatic surgery is the prototypic operation associated with significant short-term morbidity and mortality for which research over the past two decades has demonstrated a consistent and strong association between high-volume surgical centers and improved perioperative outcomes (1,2). Part of the variation in outcome between high-volume and low-volume centers may relate to the relatively uncommon nature of the operation, thus limiting the ability to develop widespread technical experience. With the inherent high baseline risks associated with pancreatic resection even in the hands of experts, pancreatic surgery has been considered to represent an operation for which regionalization may allow expertise to develop and patient outcomes to improve (3–6). The potential impact is not insignificant as current data suggests that approximately 50% of all pancreatic resections in the United States are already performed at low-volume centers with factors including geographic, socioeconomic and referral patterns limiting receipt of surgical care at high-volume centers (3,7).

Despite the theoretical benefit for patient outcomes, over the past 20 years there have been significant barriers to implementation of regionalization of pancreatic surgery. Inconvenience to the patient given travel and disruption of local life has been well recognized, extending to postoperative care and potential issues surrounding management of perioperative complications and possible hospital re-admissions (which occur with a not insignificant frequency). Furthermore, the mechanism of regionalization,

including the directive that low-volume centers must abandon performing pancreatic operations and refer to high-volume centers, has not been well defined. The efforts of regionalization of pancreatic surgery have been met with limited success as operative volumes at high-volume centers have only modestly increased, if at all (4,8,9).

While the majority of research in the volume:outcome relationship of high-risk surgical procedures has focused on short term perioperative outcomes, there is increasing evidence of an improvement in long term outcomes such as cancer-specific survival (10,11). The hypothesis between this association seems well-founded, namely that patients who suffer from complications are less likely to receive effective adjuvant treatment for their cancer (12–14). The impacts of perioperative complications may include delays in the timing of receipt of therapy to allow for recovery, a reduction in the dose or number of agents used (single agent rather than multi-drug regimen), or complete omission of adjuvant therapy. Therefore, it would seem reasonable that regionalization of surgical care for pancreatic cancer could have the benefit of delivery of optimal cancer-directed therapy and improved overall survival at the population level.

However, the international experience in regionalization of pancreatic surgical procedures has been met with mixed results. In the United States, pressure from The Leapfrog Group (a coalition of more than 150 major companies that provide employer-sponsored healthcare insurance) to

concentrate selected surgical procedures in centers with optimal outcomes has been met with limited success; less than 10% of pancreatic resections in the state of Texas shifted from low-volume to high-volume centers (3). In Europe, a comprehensive review of published data from 11 countries, Polonski *et al.* noted that only the United Kingdom and the Netherlands were able to achieve regionalization of pancreatic surgery (15). The interesting aspect of their analysis is that the UK and the Netherlands took two very different approaches to regionalization. As the UK has a system of national healthcare insurance, the UK Health Department directed all patients to be treated in specialist centers. Conversely, the Netherlands used a “grass roots” efforts in which regional centers cooperated to introduce local regionalization and with the demonstration of improved outcomes, broader networks of regionalized pancreatic surgery. There are clear differences in this “top-down” versus “bottom-up” process to implement regionalization of care; the change was nearly immediate in the UK whereas it took over a decade in the Netherlands (8,16). Even then, the greatest impact on reducing perioperative morbidity and mortality was noted in elderly patients (16).

In this issue of the *Journal of Gastrointestinal Oncology*, Nortunen *et al.* report the effect of regionalization of pancreatic surgery in Finland (17). This builds on the foundational report by Ahola *et al.* that demonstrated an improvement in perioperative outcomes as well as survival of patients with pancreatic cancer cared for in high-volume centers compared to low-volume centers in Finland (18). Thus, it was anticipated that if patients could be shifted from low-volume centers to high-volume centers through a centralization process, perioperative outcomes and perhaps survival of patients with pancreatic cancer in Finland would improve. However, in the review of centralization efforts for pancreatic surgery in Europe, it was felt that it may be difficult to enact in Finland given the low population density (particularly in Northern Finland) which may present a challenge for policy makers (15).

The process of regionalization of pancreatic cancer surgical procedures in Finland followed an approach similar to that of the Netherlands. In 2011, four regional secondary hospitals jointly decided to refer patients with pancreatic cancer requiring a surgical resection to Oulu Hospital in Northern Finland. Nortunen *et al.* compared perioperative outcomes and overall survival in the decade prior to the regionalization effort to the patient outcomes in the

following decade (17). A critical finding is that the “grass roots” effort did work; Oulu Hospital was a low volume pancreatic surgery center but rapidly became a high-volume center performing over 50 pancreatic resections per year in the decade following the regionalization effort. Interestingly, the overall perioperative complication rate did not change during the increase in operative volume nor did the pancreatic fistula rate. Short term mortality did not change, but 90-day mortality decreased. Technical expertise improved at Oulu Hospital after regionalization, with reported greater lymph node harvests, increased stage III tumor and vascular resection rates, and high frequency of ASA III patients. Other outcomes related to process of care also improved, including the hospital length of stay, referral for discussion of adjuvant therapy, administration of adjuvant therapy, and use of neoadjuvant therapy. Given these improvements, it is not surprising that the 5-year survival improved by a dramatic 50% relative increase; from 14.3% immediately prior to the regionalization effort to 21.4% after centralization of pancreatic surgery to Oulu Hospital.

This impact of this work cannot be understated—the survival of patients with pancreatic cancer in Northern Finland improved through community-based efforts to centralize pancreatic surgical care at one hospital. Although the impact on the perioperative outcomes was not as significant as would have been predicted given the shift from a low-volume to high-volume pancreatic surgery center, the improvement in care coordination demonstrates the impact of “systems approaches” in the multidisciplinary care of cancer patients to increase survival. And survival remains the best evaluative metric we have for the delivery of multimodality care to cancer patients.

There is a critical piece of this effort that is not well described in the paper, namely the effort behind the centralization of pancreatic surgery. This would be critical to inform other regions on how to successfully accomplish centralization as the benefit is well accepted. What prompted these hospitals to come together in 2011 and decide on a unified effort for regionalization of pancreatic surgical procedures? How and why was Oulu Hospital chosen to become the high-volume center after centralization? How was it negotiated for the three other hospitals to give up the surgical care of these patients? Given the geographic dispersion of the region, how did Oulu Hospital work to re-patriate the patients back to their original site of care and coordinate additional

treatment, such as chemotherapy and post treatment disease surveillance? How did Oulu Hospital prepare for the rapid increase in pancreatic surgical procedures after the initiation of regionalization?

This paper adds to the growing literature that centralization of highly complex medical care can lead to improved patient outcomes. A community-based effort of regionalization can be successful, but there remain significant barriers to broad implementation. This group achieved centralization through a cooperative effort of four hospitals, of which three lost surgical volume. This type of cooperative effort may not be possible in all regions of healthcare delivery. Furthermore, variations in healthcare insurance systems may prevent the transfer of patients among regional providers. And lastly, patients in sparsely populated areas may be accustomed to traveling for healthcare that is not the norm in other communities. Yet with those barriers, this is a goal that all should aspire to accomplish.

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