Robotic distal pancreatectomy: greatest benefit for the frail?

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Abstract: Pancreatic cancer is more common in the elderly who represent a rapidly growing part of the population. Elderly patients are a heterogeneous group and vary greatly in terms of physiologic reserves. Frailty represents a state of reduced capacity to compensate against stressors such as surgery or chemotherapy. Frailty assessment before pancreatectomy or initiation of systemic therapy correlates strongly with postoperative adverse effects, treatment related toxicity and patient outcomes. Robotic assisted surgery represents a lesser physiologic insult compared to open surgery. Most frail patients can better compensate to the stress of a robotic procedure. Robotic distal pancreatectomy is associated with a faster recovery and a reduction in major morbidity proportionate to the degree of frailty. This benefit is lost in the event of conversion to traditional open surgery. In this article we summarize current concepts on the relationship of frailty and surgical outcomes, the importance of frailty assessment for pancreatic cancer patients undergoing surgery and the benefits of robotic-assisted pancreatectomy for the frail.

Keywords: Pancreatic cancer; frailty; pancreatectomy; geriatric assessment (GA)

Introduction—general concepts

During the last century, life expectancy has doubled. By 2030, there will be 9 million people over the age of 84 in the United States (1). Elderly patients are more and more frequently referred for cancer treatment yet they are paradoxically excluded from clinical trials (2). Pancreatic cancer is predominantly a disease of the elderly with a median age at presentation of 71 years and more than 60% of newly diagnosed patients being over 65 years old (3).

Elderly patients represent a heterogeneous group in terms of physiologic reserves. It is known that elderly patients who survive the first year after surgery may have the same cancer-related survival as younger patients (4). Therefore, appropriate patient selection is needed to avoid early mortality. Frailty represents a more holistic way of patient assessment compared to age. It is associated with the aging process but it is distinct from it. It represents

the patient's vulnerability and propensity to have adverse outcomes from medical interventions. It is very frequent amongst cancer patients and correlates strongly with chemotherapy intolerance, postoperative complications and mortality (5,6).

Routine assessment tools, such as the American Society of Anesthesiology Physical Status Classification System (ASA) or the Eastern Cooperative Oncology Group score (ECOG), are not sensitive enough to correlate with the degree of patient frailty and to serve as accurate estimates of the associated operative risk (7). The two most commonly used methods to assess frailty are the physical frailty phenotype and the accumulation of deficits theory (8). The physical frailty phenotype model, is based on five elements: weight loss, physical activity, exhaustion, grip strength, and walking speed (9). The accumulation of deficits model considers comorbidities and disability to accumulate and

eventually lead to physiologic decline (10). In geriatric medicine, a geriatric assessment (GA) is a systematic evaluation of an individual's functional status, comorbidities, polypharmacy, cognitive status, nutritional status, emotional status, and social support and represents a thorough assessment of the patients multilevel vulnerabilities (11). GA preoperatively predicts 6-month mortality and post-discharge institutionalization in patients undergoing major thoracic and abdominal operations (12). Identification of patient vulnerabilities provides an opportunity to intervene and realize improved outcomes. An example of GA with assessment options and specific courses of action from a Delphi Consensus of Geriatric Oncology Experts was recently published (13).

As a result of the strong association between GA and cancer treatment outcomes, the International Society of Geriatric Oncology recommends that GA should be used in older patients with cancer to detect unaddressed problems (14). Similarly, the American College of Surgeons, in collaboration with the American Geriatric Society, created best-practice guidelines to identify high-risk patients, to prevent perioperative adverse outcomes, and to achieve optimal perioperative care of the surgical patient (15). Currently, although there are multiple ways to obtain a GA and an estimate of patient's frailty (16) the optimal and universally accepted method that is both comprehensive and time effective in daily clinical practice remains to be determined (5).

Geriatrics, frailty and pancreatic surgery

Single institution studies have shown that with appropriate patient selection, pancreatic surgery can be performed safely for the elderly with similar short and long term outcomes to younger patients (17,18). However, in statewide and national data the outcomes seem to be less favorable for the elderly (19,20). There is a proportionate increase of in-hospital mortality, length of stay, and discharge to nursing facility in the older age groups. Even in this setting though, high volume institutions are associated with lower morbidity and mortality reflecting appropriate patient selection and management (20).

Frailty predicts outcomes after pancreatic surgery. A National Surgical Quality Improvement Program (NSQIP) study on 13,020 patients who underwent either pancreaticoduodenectomy or distal pancreatectomy between 2005 and 2010, demonstrated a stepwise increase of major morbidity and mortality from non-frail to frail

patients after adjusting for demographics, nutritional factors and type of pancreatectomy (21). In a prospective study with older patients undergoing pancreaticoduodenectomy, preoperative GA predicted major complications, longer hospital stays and ICU admissions after controlling for age, BMI, ASA score and comorbidities (22). A significant proportion of patients, up to half in that study, had unrecognized GA deficits with self-reported exhaustion being the most important GA predictor of important outcomes (22).

In this context, the increasing use of minimally invasive surgery changes the landscape of pancreatic surgery. Laparoscopic and robotic approaches are being increasingly utilized for pancreatic resections, thus it becomes of great interest to investigate the outcomes of minimally invasive pancreatectomies for the frail.

Robotic distal pancreatectomy for the frail

Since the first reports of robotic assisted pancreatectomies, the number of pancreatic resections performed with the utilization of the robotic platform has increased significantly (23). The utilization of small incisions, with less analgesic requirements represents a smaller physiologic insult compared to open surgery, leads to faster patient recovery and appears as an ideal option for the frail patients who cannot compensate well to physiologic stressors. Not surprisingly, minimally invasive compared to open distal pancreatectomies are associated with shorter hospitalizations and reduced complications (24). The existing data comparing robotic to laparoscopic pancreatectomies point towards comparable outcomes (25). However the existing studies do not stratify for the frailty status of the patients (24).

In a report utilizing NSQIP data on 1,038 elective distal pancreatectomies we found a proportionate increase of major complications with worsening frailty (26). Minimally invasive distal pancreatectomy (MIDP) was associated with a lower risk compared to open distal pancreatectomy (ODP), but this benefit was lost in the event of conversion (26). Robotic distal pancreatectomies were particular advantageous as they had a lower risk of conversion compared to laparoscopic distal pancreatectomies in that series which is similar to findings of other studies (25,27,28). Approximately a third of the patients in that study were 70 years old or more at the time of surgery. There was no difference in the utilization of minimally invasive surgery for the elderly and, similar to younger patients, they experienced a lower rate of major

complications with minimally invasive surgery. Even though robotic distal pancreatectomies were more frequently performed for benign lesions, their equivalent oncologic outcome to open surgery when performed for cancer has been demonstrated (29).

Summary—conclusions and future perspectives

Frailty assessment is essential in modern oncogeriatrics. As the TNM system stages cancer, frailty assessment stages the patients suitability for surgery and detects unrecognized with traditional risk assessment tools defects that are associated with worse outcomes and can guide treatment decisions and perioperative management. With cancer being an increasingly common problem in the very elderly, the ability to assess and intervene in patient's frailty is a critical component of contemporary oncologic care. The development of frailty assessment tools with universal acceptance and adoption will allow comparisons between studies and will facilitate the evolution of the field.

A large proportion of pancreatic cancer patients are frail, which is associated with worse postoperative outcome, major morbidity and mortality. GA of the patient with pancreatic cancer can reveal unrecognized deficits and has the potential to improve patient outcomes through prehabilitation.

Robotic distal pancreatectomy represents a smaller physiologic insult compared to open pancreatectomy that frail patients are better able to tolerate. Not surprisingly, it is associated with fewer major complications. The benefits of minimally invasive pancreatectomy are lost in the event of conversion and robotic assisted resections are beneficial especially because of the low conversion rates. Prospective clinical trials in pancreatic cancer need to incorporate frailty assessment tools and the access of the elderly to these is absolutely essential.

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