

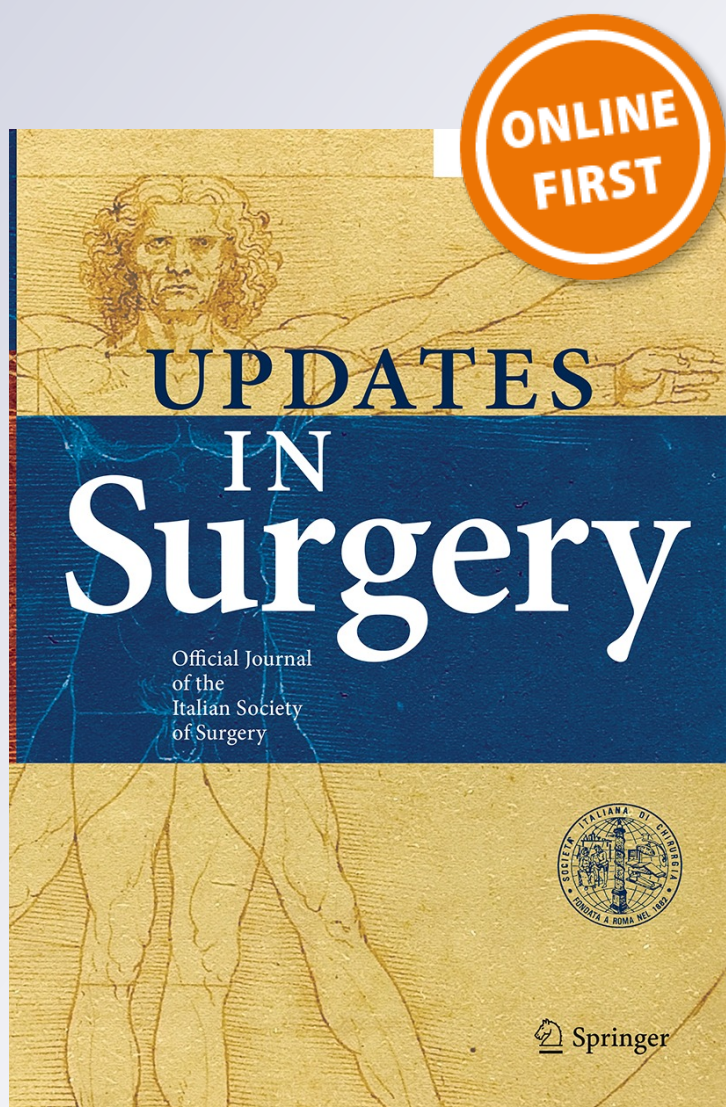
Volume and outcomes after esophageal cancer surgery: the experience of the Region of Lombardy—Italy

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Volume and outcomes after esophageal cancer surgery: the experience of the Region of Lombardy—Italy

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Abstract Surgical procedures for cancer of the esophagus are complex operations, with considerable perioperative morbidity and mortality that require high use of resources. Recent reports indicate better results with centralization of these procedures, referring patients to high-volume dedicated hospitals. The aim of this study was to analyze the results of resective surgery for cancer of the esophagus and cardia performed in hospitals of the Region of Lombardy over the period 2005–2011, in terms of volume of operations, 30-day postoperative mortality, and length of hospitalization. The results showed a significant relation between reduction of mortality rate and number of resections performed in intermediate- and high-volume centers. In the Region of Lombardy there is an inverse relation between volume of esophagectomies in the single hospital, length of postoperative hospital stay, and postoperative 30-day mortality. Centralization of care on a regional level and standardized clinical pathways of diagnosis and care at single healthcare organizations and professionals should be implemented to improve clinical results in patients affected by esophageal and cardia cancer.

Keywords Hospital volume · Treatment outcome · Esophageal neoplasms · Esophagectomy/mortality

Introduction

Cancer of the esophagus has a dismal prognosis [1]. Surgical resection is considered in case of local disease. The mortality rate for this intervention is still high, even if significant progresses have been made in perioperative care and surgical technique [2]. Among factors considered to have an impact on postoperative mortality rate for esophagectomy, procedural volume seems to be an important parameter. Differences in outcomes between high-volume and low-volume providers have been reported [3, 4] and some authors believe that a high-risk low-volume procedure such as esophagectomy should be performed in high-volume centers to improve patients' outcome [5]. Some European countries, based on these data, have started programs of regionalization of upper gastrointestinal surgery [5–7]. The Italian Health Ministry through the National Program for evaluation of Results (PNE-AGENAS) [8] is collecting data to evaluate hospital performances based on some indicators such as hospital mortality for some oncological surgical procedures. Cancer of the esophagus is not a common disease in Italy: the number of esophagectomies for malignant tumor of the esophagus (cardia excluded) performed in Italy in 2011 was 538. Many of these procedures were performed in low-volume hospitals: 138 hospitals performed among 1 and 10 operations, 6 hospitals between 11 and 20 operations and 4 hospitals more than 20 procedures. At the present time there are few data on the impact of center volume on mortality for esophageal resections in our Country and it is still questionable if concentration of esophagectomies with high-volume providers could improve overall patient outcome. In

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2011 Lombardy, one of the 20 Italian administrative regions, had on its territory 220 hospitals, several universities and some excellent healthcare facilities. Lombardy has a database that includes the form used for diagnosis and codified ICD9 procedures (SDO) at hospital discharge. This database can be used to identify patients grouped by pathology and operation.

The aim of this study is to analyze the influence of hospital volume on postoperative 30-day mortality rates for patients undergoing major resective surgery for cancer of the esophagus and cardia in the Region of Lombardy.

Methods

The database of the region of Lombardy was analyzed for ICD-9-CM codes at hospital discharge over the period 2005–2011. The ICD-9-CM codes for the diagnosis of cancer of the esophagus and cardia were selected (code 150, 151); these data were crossed with the procedure codes 42. and 43. for esophagectomy and gastrectomy. The number of patients who had a resection for cancer of the esophagus and cardia in that period in every hospital in Lombardy was therefore identified. The length of postoperative stay, as an indicator of surgical morbidity, and the 30-day postoperative mortality, were registered for these patients. The hospitals were divided into three groups based on the number of resections carried out during the period 2005–2011: group A, less than 50 operations (low-volume hospitals— <7.1 /year on average), group B, between 50 and 149 operations (intermediate-volume hospitals—between 7 and 21/year on average), and group C, more than 150 operations (high-volume hospitals—more than 21/year on average).

The distribution of individual characteristics was evaluated by simple descriptive statistics. Differences among distributions of selected variables were evaluated using the Fisher exact tests for categorical data and the Wilcoxon rank sum test for continuous variables.

Length of postoperative stay and 30-day mortality rate were related to hospital volume: main outcome was represented by death occurred within 30 days of surgery. To estimate the association between volume and 30-day mortality unconditional logistic model was fitted by computing odds ratios (OR) and corresponding 95 % confidence intervals (95 % CI). The model included terms for age, sex, and Charlson's co-morbidity index [9] and used group A hospitals as a reference category.

Results

Two thousand eight hundred and one resections for cancer of the esophagus and cardia were performed in Lombardy

over the period 2005–2011 (Fig. 1). The male/female ratio was 3:6; more than 50 % of patients were 60–75 year old (Fig. 2).

The procedures were performed in 111 hospitals. Figure 3 reports the classification of hospitals based on their volume: ninety-eight hospitals were classified in group A (low-volume), 9 in group B (intermediate-volume), and 4 in group C (high-volume). Group A hospitals performed 1,208 procedures over the 7 year period (1,7 procedure/hospital/year); group B performed 679 procedures (10,1 procedure/hospital/year) and group C performed 914 procedures (32,6 procedure/hospital/year). Patients treated in high-volume hospitals had more serious comorbidities (mean Charlson's score 1.29) than those treated in low- and intermediate-volume hospitals (mean Charlson's score 1.25) (p value 0.7), but were younger and with a lower proportion of patients with 2 or more comorbidities (Table 1).

The median hospital stay was 20 days in group C hospitals and more than 25 days in group A and B hospitals.

The 30-day mortality rate was 5.7, 2.6, and 1.7 %, respectively in low-, intermediate-, and high-volume

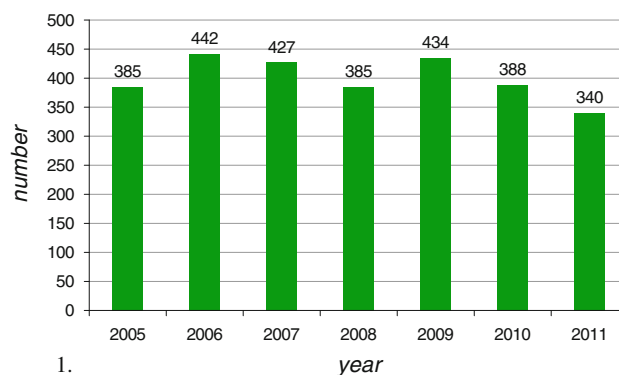


Fig. 1 Number of resections for cancer of the esophagus and cardia performed in Lombardy over the period 2005–2011

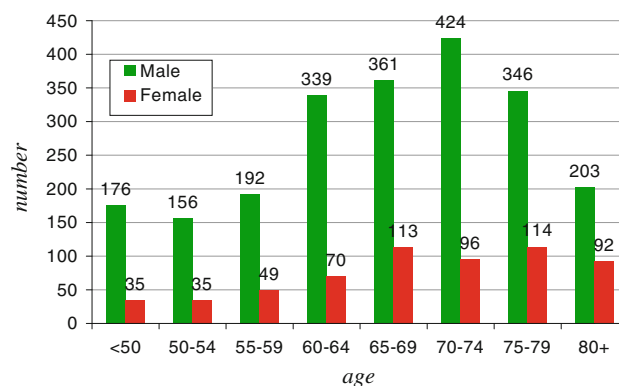


Fig. 2 Age and gender of 2,801 patients who underwent resective surgery for cancer of the esophagus and cardia in Lombardy over the period 2005–2011

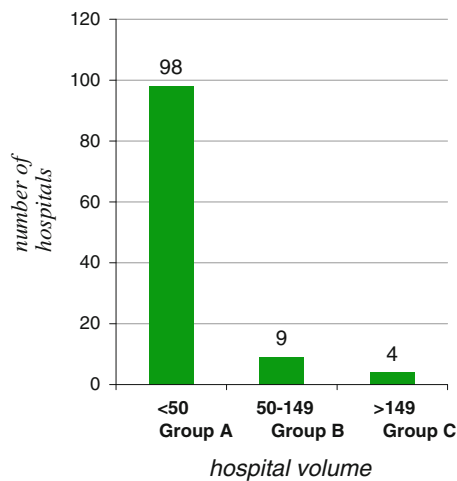


Fig. 3 This figure reports the number of low (*group A*) intermediate (*group B*) and high-volume (*group C*) hospitals were 2,801 resective procedures were performed

Table 1 Age distribution and number of comorbidities in patients treated in low-volume (*group A*), intermediate-volume (*group B*) and high-volume (*group C*) hospitals

	Group A	Group B	Group C	<i>p</i> -value
Age (mean–SE)	68.76–0.31	66.79–0.40	64.33–0.37	<0.001*
Comorbidity				
NO	88.58 %	85.27 %	93.11 %	
1	10.43 %	13.70 %	6.24 %	
2+	0.99 %	1.03 %	0.66 %	<0.001**

* From Wilcoxon rank sum test

** From Fisher exact test

hospitals (Fig. 4). The odds ratio of 30-day mortality (corrected in a logistic model for age, sex, and comorbidity index) was 0.47 (95 % CI 0.28–0.78) for hospitals in Group B and 0.36 (95 % CI 0.20–0.53) for hospitals in Group C ($p < 0.0001$) (Fig. 5).

Discussion

In 1979 Luft et al. [10] described that, for selected procedures, a hospital volume–outcome relationship was evident. Since then, there have been many reports in the medical literature suggesting that procedural volume is an important determinant of outcome in cancer surgery: this relationship is especially evident for high-risk, low-volume procedures, such as esophagectomies [11–13]. Notwithstanding some conflicting results, it clearly appears that concentration of these procedures in high-volume centers could lead to better short-term results and decreased mortality [5, 13]. There are several aspects of this relationship which are still unclear: among them the cutoff values to

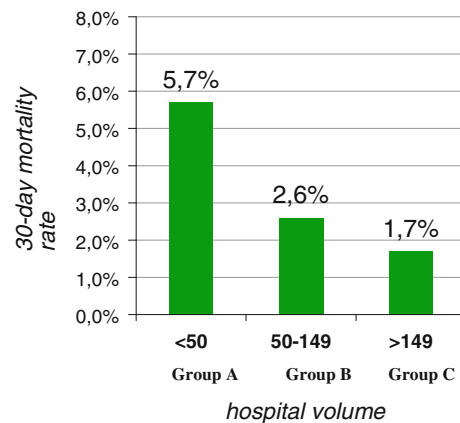


Fig. 4 This figure reports the 30-day mortality rate in low (*group A*) intermediate (*group B*) and high (*group C*) volume hospitals

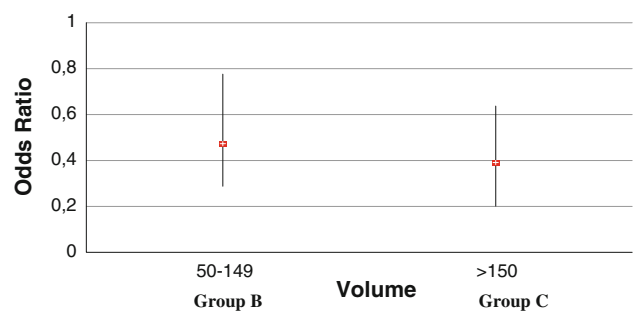


Fig. 5 Odds ratio of death probability; 30-day mortality rate for low-volume hospitals (*group A*) is used as a reference category

define high and low-volume centers are variously defined, with criteria that are not objective [14]. Moreover, although surgeon and hospital volume have significant influence on the outcome of very complex surgical procedures such as esophagectomy, there is a higher reliance on other hospital services that influence the outcome, such as the “supporting cast” from the hospital, including ICU, nursing, physical therapy, and nutrition [15, 16].

Following these results, in UK, in 2001, the NHS started a process of centralizing upper gastrointestinal cancer services, recommending that upper gastrointestinal cancer centers should perform at least 40 esophagectomies and 60 gastrectomies for cancer each year [6].

There are few data on the results of upper gastrointestinal surgery in our country, even if the Italian Health Ministry through the National Program for evaluation of Results (PNE-AGENAS) [8] has recently started a program for evaluating hospital performances based on some indicators such as hospital mortality for some oncological surgical procedures including upper gastrointestinal surgery.

Italy has a population of more than 61 million. The annual incidence of cancer of the esophagus in Italy during 2006 has been of 2,573 cases (2,025 new cases among men and 548 among women) [17]. Both incidence and mortality

for cancer of the esophagus are decreasing. Still postoperative mortality for esophagectomy is high and long-term prognosis after surgical resection is poor [1, 2]. Attention should be given to parameters that may influence the results of surgery, both in terms of postoperative mortality and postoperative morbidity, which strictly influences total health care costs [18].

We were interested in evaluating where patients with cancer of the esophagus receive surgical cure in Lombardy. We therefore analyzed the ICD-9-CM codes at hospital discharge in the database of the region of Lombardy looking for surgical resections for esophageal and cardia cancer in regional hospitals performed over the period 2005–2011. In 2011 Lombardy had a population of 9,920,000 persons, and 340 surgical resections for cancer of the esophagus and cardia were performed in that year. Forty three percent of resections performed during the analyzed period (2005–2011) were made in low-volume hospitals; only 32.6 % of resections were performed in the 4 high-volume hospitals. We analyzed the impact of hospital volume on postoperative mortality and found an inverse relation between hospital volume for surgical resections for cancer of the esophagus and cardia and postoperative 30-day mortality rate: a significant reduction of mortality rate after resections was found when comparing high-volume with intermediate- and low-volume centers.

This result parallels what has been described in other countries where it was the base for starting centralization programs [19].

It is interesting to notice that, though patients treated in high-volume centers had more comorbidities, they had shorter postoperative stay in comparison to patients treated in low-volume centers: this might indicate that postoperative morbidity rate in high-volume centers is probably lower, and probably treatment of complications is more effective [20]. Reducing postoperative morbidity may lead to a significant decrease of costs for the health care system and should therefore be particularly aimed for.

We are however conscious of the fact that these data need to be cautiously interpreted since the reasons of the relationship between hospital volume and perioperative results after esophagectomy are not completely clear: quality of care and outcomes after oncological major upper gastrointestinal surgery are the result of interactions between surgeons, anesthesiologist, intensive care unit staff, nursing staff and, more in general, hospital setting [21].

With this in mind, it should be considered that a policy of centralization of care for upper gastrointestinal surgery on a regional level in dedicated surgical units of high-volume referral hospitals might be beneficial for care of these patients. Procedural volume should not be the sole quality criteria, but it is easier that in these setting well-recognized quality determinants, such as standardized

clinical pathways for perioperative care, could be implemented and applied to improve clinical results of patients affected by esophageal and cardia cancer [22, 23].

Conflict of interest The authors declare that they have no conflict of interest.

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