

available at www.sciencedirect.comjournal homepage: www.ejconline.com

Cost comparison study of two different follow-up protocols after surgery for oesophageal cancer

Suzanne Polinder^a, Els M.L. Verschuur^{b,*}, Peter D. Siersema^{b,d}, Ernst J. Kuipers^{b,c}, Ewout W. Steyerberg^a

^aDepartment of Public Health, Erasmus MC University Medical Center, Rotterdam, The Netherlands

^bDepartment of Gastroenterology and Hepatology, Erasmus MC University Medical Center, Rotterdam, Sparrenhof 36, 6951 MB Dieren, The Netherlands

^cInternal Medicine, Erasmus MC University Medical Center, Rotterdam, The Netherlands

^dDepartment of Gastroenterology and Hepatology, University Medical Center Utrecht, The Netherlands

ARTICLE INFO

Article history:

Received 11 January 2009

Received in revised form 16 March 2009

Accepted 23 March 2009

Available online 22 April 2009

Keywords:

Oesophageal cancer

Oesophageal cancer surgery

Cost analysis

Nurse-led follow-up

Randomised trial

ABSTRACT

Background and aim: Costs of follow-up strategies in patients after surgery for oesophageal cancer have not been evaluated. We therefore randomised 109 patients to standard outpatient clinic follow-up by a surgeon ($n = 55$) or home visits by a specialist nurse ($n = 54$) and compared costs between these two strategies.

Method: Cost comparisons included comprehensive data on hospital costs, diagnostic interventions and extramural care. Detailed information on health care consumption was obtained from a case record form at 6 weeks, and 3, 6, 9 and 12 months after randomisation.

Results: Total medical costs were lower for nurse-led follow-up (€2592 versus €3798) than standard follow-up, although this difference was not statistically significant ($p = 0.11$). This advantage in the nurse-led follow-up group was mainly due to lower costs for follow-up visits (€234 versus €503; $p < 0.001$), and a trend towards lower costs for total intramural care (€1477 versus €2277; $p = 0.19$).

Conclusion: Nurse-led follow-up of patients after oesophageal cancer surgery is likely to be cost effective and may even generate cost savings. The results of this study further support a specific role of nurses in the medical care of patients with malignant diseases.

© 2009 Elsevier Ltd. All rights reserved.

1. Introduction

The incidence of oesophageal cancer has risen dramatically over the past two decades in the Western world, due to a marked increase in the incidence of adenocarcinoma.^{1,2} Despite recent advances in the curative treatment of oesophageal cancer,³ less than 50% of patients have operable disease

at presentation. Surgery for oesophageal cancer is a serious life event, which is often accompanied by significant morbidity and influences quality of life of patients.^{4–9} It is well known that approximately 30% of patients will develop recurrent cancer within the first year after oesophageal resection. Therefore, treatment of physical problems and counselling of emotional problems are important issues during follow-up.¹⁰

* Corresponding author. Tel.: +31 313 413309; fax: +31 104 089449.

E-mail address: emlvers@wxs.nl (E.M.L. Verschuur).

0959-8049/\$ - see front matter © 2009 Elsevier Ltd. All rights reserved.

doi:10.1016/j.ejca.2009.03.021

Over the last few years, the role of nurses in clinical medicine has been expanding.¹¹ As before, nurses provide services which complement or extend the role of physicians. Recently, nurses increasingly perform tasks and procedures previously performed by physicians.^{12,13} One of the ways in which this is done is by the introduction of nurse-led clinics for the care of patients with oncological disorders.^{14–17}

In the light of the commonly held view that nurse-led care may generate cost savings, it is remarkable that the economic implications of this in the gastrointestinal practice have only been evaluated in a few studies.^{18–20} In this regard, it has been demonstrated that costs of flexible sigmoidoscopy^{18,19} and capsule endoscopy²⁰ are lower if performed by nurses than physicians. Costs were, however, only ‘roughly’ calculated, using charges and with little information about the differentiation of these costs. As costs increasingly play an important role in clinical decision making, nurse-led follow-up could add in decreasing costs follow-up after oesophageal cancer surgery. To date, there have been no cost-analysis studies comparing different follow-up strategies after surgery for oesophageal cancer, i.e. outpatient clinic follow-up by a surgeon versus home visits by a specialist nurse. We therefore performed a randomised trial (Trial registration: ISRCN91288232), comparing total costs of these two follow-up regimens in patients who had undergone an oesophageal resection with curative intent.

2. Materials and methods

2.1. Study population

Patients were recruited from a university hospital ($n = 105$) and a general hospital ($n = 4$). Between January 2004 and February 2006, 109 consecutive patients who had undergone oesophageal resection were randomised to follow-up by surgeons at the outpatient clinic (standard follow-up) or home visits performed by a specialist nurse (nurse-led follow-up). Inclusion criteria included surgery with curative intent for oesophageal or gastric cardia cancer and written

informed consent. The two follow-up groups were similar with respect to patient characteristics (Table 1). Both follow-up groups predominantly consisted of males, with a mean age of 61 years. The study was approved by the Central Committee on Research Involving Human Subjects in the Netherlands.

2.2. Study end-points

Clinical outcomes were health-related quality of life (HRQoL), medical outcome, patient satisfaction and costs. The clinical outcome has been presented in detail elsewhere.²¹ In the current study, we thoroughly evaluated medical costs of the two follow-up strategies. Costs were studied from a societal perspective and were estimated for a period of 12 months follow-up in a total of 95 (87%) patients or until death in 14 (13%) patients.

2.3. Data collection

Patients were randomised 3 weeks after hospital discharge, during the first visit to the outpatient clinic after the operation. The next scheduled follow-up visits were at 6 weeks, and 3, 6, 9 and 12 months after randomisation. The participating surgeons as well as the specialist nurse filled out standardised case record forms (CRFs) during the follow-up visits. For each patient, we registered the number of inpatient days, the use, type and number of diagnostic procedures and, if indicated, the use, type and treatment procedures that were performed. In addition, visits to the outpatient clinic and general practitioners were registered.

HRQoL was assessed using the EuroQol-5D measure,²² the oncology-specific European Organization for Research and Treatment of Cancer (EORTC) QLQ-C30 measure²³ and the oesophageal cancer specific EORTC QLQ-OES18 measure.²⁴ HRQoL questionnaires were completed at randomisation, and at 4, 7 and 13 months after randomisation. The questionnaire assessing patient satisfaction was filled out 7 months after randomisation.

Table 1 – Patient characteristics of 109 patients randomised to standard follow-up or nurse-led follow-up after oesophageal cancer surgery.

	Standard follow-up $n = 55$	Nurse-led follow-up $n = 54$
Age; mean \pm SD	61 \pm 7	61 \pm 9
Gender; no. of patients (%)		
Male	41 (75)	40 (76)
Female	14 (25)	14 (24)
Radiation and/or chemotherapy prior to surgery		
Total	17 (31%)	14 (26%)
– Chemotherapy	12	6
– Radiation and chemotherapy	5	8
Surgical technique		
– Transhiatal oesophagectomy	41 (75%)	43 (80%)
– Transthoracic oesophagectomy	14 (25%)	11 (20%)
Median dysphagia score ^a at baseline	0	0

a Graded as: 0 = ability to eat a normal diet; 1 = ability to eat some solids; 2 = ability to eat some semisolids only; 3 = ability to swallow liquids only; 4 = complete dysphagia.

2.4. Cost calculations

Real medical costs were calculated by multiplying the volumes of health care use with the corresponding unit prices. For the calculation of the total medical costs per patient, we distinguished intramural medical costs (inpatient days, health practitioner care, full cost prices of medical treatment and other medical procedures) and extramural medical costs (general practitioner). Costs caused by loss of production due to absence from work were not taken into account, because the majority of patients had already retired from work.

For the most important cost items, unit prices were determined by following the micro-costing method,²⁵ which is based on a detailed inventory and measurement of all resources used. Costs for inpatient days in the hospital were estimated as real basic costs per day using detailed information from the financial department of the hospital. We made a distinction between costs of the university and the general hospital. These estimates included overhead and indirect costs. From a differential point of view, i.e. the comparison of the two follow-up strategies, some diagnostic interventions, such as X-rays and MRI scans, were decided to be less relevant. We chose not to spend much time and effort in exploring costs that were unlikely to make a large difference in the study result,²⁶ for example, costs that were low in price and in volume. For these, we used charges as a proxy of real costs. In the Netherlands, a detailed 'fee for service' system is used for the remuneration of medical interventions and diagnostic procedures. In order to calculate the costs of medication use, average charges for analgesics, antibiotics and additional medications were used. We reported costs in Euro for the year 2006. Discounting was not relevant because of the limited time horizon.

2.5. Statistical analysis

All analyses were performed on an intention-to-treat basis. The cost differences between standard follow-up and nurse-led follow-up were analysed using the Mann-Whitney *U* test.

Since cost data per patient (but not per day care) are typically highly skewed, we used non-parametric bootstrap techniques to derive a 95% confidence interval for the differences in distributions of the direct medical costs.²⁷

3. Results

3.1. Clinical outcome

In total, 11 (20%) patients of the nurse-led follow-up group and 16 (29%) patients of the standard follow-up group were diagnosed with recurrent loco regional tumour and/or metastases 1 year after oesophageal resection ($p = 0.50$). Of these, nine (33%) patients received palliative chemotherapy and five (19%) patients were treated with external beam radiation therapy. Fourteen (13%) patients died within the first year after surgery. These findings were equally distributed between the two follow-up groups.

Mean quality of life scores were similar in both follow-up groups (Table 2). For the whole group, a significant improvement was found on the dysphagia, eating and indigestion scales (QLQ-OES18), on the fatigue, physical, role, cognitive and social functioning scales and in global health (QLQ-C30). Mean overall patient satisfaction rate was 8.3 ± 1.2 for the nurse-led follow-up group and 7.9 ± 1.2 for the standard follow-up group ($p = 0.14$).

3.2. Costs

A cost-minimisation analysis was performed, since the clinical and quality of life outcomes of both patient groups were not different and therefore only costs could be compared.^{25,26}

Table 3 gives an overview of the average health care use and costs per patient for standard and nurse-led follow-up of patients after oesophageal cancer surgery. The total average costs per patient were not statistically significantly higher for standard follow-up than nurse-led follow-up (€3798 versus €2592; $p = 0.11$). Costs of nurse-led follow-up visits were lower than those of standard follow-up (€234 versus €503; $p < 0.001$).

Table 2 – Outcome in quality of life of 109 patients randomised to standard follow-up or nurse-led follow-up after oesophageal cancer surgery at 13 months of follow-up.

	Standard follow-up <i>n</i> = 55	Nurse-led follow-up <i>n</i> = 54
EuroQol-5D (0–100) ^a	74	76
EuroQol VAS scale ^a	69	71
EORTC QLQ-C30 ^b		
– Functional scales	No differences in scale scores	
– Symptom scales	No differences in scale scores	
– Global health status (0–100) ^a	71	73
EORTC QLQ-OES18 ^c		
– Scales related to food intake	No differences in scale scores	
– Single item scales	No differences in scale scores	
– Pain scale (100–0) ^a	10	9

a $p = \text{NS}$.

b The EORTC QLQ-C30 incorporates five functional scales (physical, role, emotional, cognitive, social), three symptom scales (fatigue, nausea/vomiting, pain) and a global health/quality of life scale.

c The EORTC QLQ-OES18 incorporates five multi-item scales (dysphagia, eating, deglutition, indigestion, pain) and four single symptom scales (having a dry mouth, troublesome taste, troublesome coughing, troublesome talking).

Table 3 – Average health care use and costs (€, 2006) per patient during standard follow-up or nurse-led follow-up after oesophageal cancer surgery.

Cost category	Cost prize	Standard follow-up		Nurse-led follow-up		95% CI ^a Mann-Whitney
		n = 55		n = 54		
		Volume	Costs	Volume	Costs	
Costs follow-up visits		5.0	503	4.7	234	<0.001 (230 to 303)
Total intramural care						
Inpatient days						
– Hospital (academic)	553	1.9	1046	0.4	202	
– Hospital (general)	405	2	802	1.4	585	
– Nursing home/hospice	184	0.4	70	2.5	453	
Outpatient clinic						
– Physician (academic)	144	2.1	304	1.35	195	
– Physician (general)	104	0.5	55	0.4	42	
			2277		1477	0.19 (–1252 to 2412)
Total diagnostic procedures						
X-ray thorax/abdomen/skeleton	60	0.4	24	0.4	23	
Ultrasound neck/abdomen	45	0.1	5	0.0	0	
CT-scan	140	0.8	107	0.3	39	
MRI	234	0.1	21	0.1	26	
Blood tests	Variable		59		12	
Histology biopsies	50	0.1	3	0.1	3	
Laryngoscopy	87	0.1	8	0.0	3	
Gastroscopy (+dilation)	345 (+42)	1.2	457	1.3	479	
Colonoscopy	75	0.1	5	0.0	3	
			689		588	0.34 (–242 to 323)
Total additional treatment						
Chemotherapy	368	0.7	248	0.3	95	
Radiation	19	0.4	7	0.2	4	
Stent placement	1600	0.0	0	0.1	83	
			255		182	0.29 (–234 to 314)
Extramural care						
General practitioner (inpatient)	20	1.8	35	2.7	54	
General practitioner (home visits)	39	1.0	39	1.5	57	
			74		111	0.97 (–64 to 7)
Total costs per patient			3798		2592	0.11 (–824 to 2972)

a Derived from 2000 bootstrap samples drawn with replacement.

a Derived from 2000 bootstrap samples drawn with replacement.

According to the protocol, patients were scheduled for five follow-up visits in the first year after surgery. This was in fact performed in 82% of patients in the nurse-led follow-up group and in 60% of those in the standard follow-up group ($p = 0.02$). In the standard follow-up group, 14 (25%) patients had more than 5 consultations, compared to 1 (2%) patient in the nurse-led follow-up group ($p = 0.02$).

Although not statistically significant, the costs for intramural care were the highest cost category in both follow-up strategies, and were higher for standard follow-up than for nurse-led follow-up (€2277 versus €1477; $p = 0.19$). The mean length of hospital stay was longer for patients randomised to standard follow-up (17.8 versus 8.9 days; $p = 0.07$), whereas the mean length of stay in a nursing home was longer for patients in the nurse-led follow-up group (2.5 versus 0.4 days). The latter was, however, mainly due to the admission of one patient, who stayed in a nursing home for a total period of 127 days. In total, 43 patients (>75%) in each follow-up group were not admitted to a hospital or a nursing home.

Costs of diagnostic procedures during follow-up were slightly, but not statistically significantly, higher in the standard follow-up group than the nurse-led follow-up group (€689 versus €588; $p = 0.34$). The mean costs for consulting a

general practitioner were €111 for nurse-led follow-up and €74 for standard follow-up ($p = 0.97$).

4. Discussion

In the present study, we compared total costs of home visits by a specialist nurse with standard follow-up visits by surgeons to the outpatient clinic in patients after surgery for oesophageal cancer. Nurse-led follow-up was found to be cheaper than standard follow-up (€2592 versus €3798). Nevertheless, this difference was not statistically significant. The largest cost differences were found in the costs of follow-up visits (€234 versus €503; $p < 0.001$) and those of intramural care (€1477 versus €2277; NS). In a recently published study, we reported that clinical outcome in patients after oesophageal cancer surgery was not different between the two follow-up strategies. Moreover, from the perspective of patients, quality of life of patients and patient satisfaction were also not found to be different.²¹

It is remarkable that economic implications of involvement of nurses in the oncological practice have only been evaluated in a few studies.^{14,15,17–20} As costs increasingly play an important role in clinical decision making, nurse-led fol-

low-up could add in decreasing costs follow-up after oesophageal cancer surgery. To our knowledge, no studies have compared the costs of different follow-up strategies in patients after oesophageal cancer surgery. The economic implications of nurses working in the endoscopic practice has, however, been evaluated.^{18–20} All these studies reported that costs were lower if procedures, particularly sigmoidoscopy and video capsule endoscopy, were performed by trained nurses instead of physicians. In a study of patients undergoing pelvic radiotherapy, nurse-led follow-up was compared with conventional medical care.¹⁴ The results suggested that specialist nurses provided comparable follow-up results in terms of clinical outcome compared to those of physicians. Moreover, nurse-led follow-up resulted in a 31% cost reduction.

However, in above-mentioned studies^{18–20} costs were only 'roughly' calculated, using charges and with only little information about the differentiation of these costs. Since there is no detailed information available on the costs in the above-mentioned articles, it is not possible to make cost comparisons between these studies and ours. Furthermore, cost comparisons between medical treatments and their follow-up periods are often based only on hospital admissions and diagnostics. Cost comparisons between interventions may vary substantially, depending on which, and how many, components are included in a total cost equation.²⁸ Our study showed that both intramural care and follow-up visits are important cost categories.

The results of our study also suggest that nurse-led follow-up might be able to change patterns of use of medical services, as fewer diagnostic procedures and fewer treatments were performed in patients in the nurse-led follow-up group compared to those followed up by a physician. This did not translate in inferior results of clinical outcome. In this regard, it is important to realise that the early detection of recurrent tumour after oesophageal cancer surgery currently prompts a palliative policy of symptoms, as, for now, evidence-based curative treatment options are not available.

Patients in the nurse-led follow-up group more often had a consultation with a general practitioner. This can be interpreted as evidence that in some cases general practitioners substituted the expertise of the specialist nurse. On the other hand, this probably resulted at the same in a more appropriate use of care in the home situation without consulting a medical specialist for problems that can be dealt with outside the hospital. Nurse-led follow-up may well have a role in making oncological care more responsive to individual needs, and reduce the burden of hospital visits and performing unnecessary test and investigations in patients.

Follow-up of patients with a high risk of developing metastases is demanding, since the mortality rate is high.²⁹ Moreover, in a palliative setting, it may be difficult to differentiate between health care costs that can be attributed to the consequences of the treatment itself, i.e. the oesophageal resection, or those of the palliative stage of the disease. For instance, the prolonged time that some patients were admitted to a hospital and/or nursing home (with periods as long as 145, 72 and 44 days in the present study) may not directly be related to the follow-up itself, but more to the advanced stage of the disease. However, even when we leave these 'palliation-related costs' out of consideration, this did

not affect the conclusion that nurse-led follow-up of this patient group was likely to be less expensive.

In conclusion, the results of this study may add to the emerging body of evidence supporting the cost effectiveness of nurses involved in the medical care of patients with cancer, particularly in cancer types, such as oesophageal cancer or pancreatic cancer, in which recurrent or metastatic malignancy often means that no evidence-based curative treatment option is available. In our opinion, the results of this study support a further differentiation of medical activities, in which training and personal skills of different groups of health care workers will be most optimally used in the care of patients.

Conflict of interest statement

None declared.

REFERENCES

1. Botterweck AA, Schouten LJ, Volovics A, Dorant E, van Den Brandt PA. Trends in incidence of adenocarcinoma of the oesophagus and gastric cardia in ten European countries. *Int J Epidemiol* 2000 Aug;**29**(4):645–54.
2. Devesa SS, Blot WJ, Fraumeni Jr JF. Changing patterns in the incidence of esophageal and gastric carcinoma in the United States. *Cancer* 1998;**83**(10):2049–53.
3. Stein HJ, Siewert JR. Improved prognosis of respected esophageal cancer. *World J Surg* 2004 Jun;**28**(6):520–5.
4. Blazeby JM, Farndon JR, Donovan J, Alderson D. A prospective longitudinal study examining the quality of life of patients with esophageal carcinoma. *Cancer* 2000;**88**(8):1781–7.
5. Brooks JA, Kesler KA, Johnson CS, Ciaccia D, Brown JW. Prospective analysis of quality of life after surgical resection for esophageal cancer: preliminary results. *J Surg Oncol* 2002 Dec;**81**(4):185–94.
6. De Boer AG, Genovesi PI, Sprangers MA, Van Sandick JW, Obertop H, Van Lanschot JJ. Quality of life in long-term survivors after curative transhiatal oesophagectomy for oesophageal carcinoma. *Br J Surg* 2000 Dec;**87**(12):1716–21.
7. Zieren HU, Jacobi CA, Zieren J, Muller JM. Quality of life following resection of oesophageal carcinoma. *Br J Surg* 1996 Dec;**83**(12):1772–5.
8. Baba M, Aikou T, Natsugoe S, Kusano C, Shimada M, Kimura S, et al. Appraisal of ten-year survival following esophagectomy for carcinoma of the esophagus with emphasis on quality of life. *World J Surg* 1997;**21**(3):282–5 [discussion 6].
9. McLarty AJ, Deschamps C, Trastek VF, Allen MS, Paironero PC, Harmsen WS. Esophageal resection for cancer of the esophagus: long-term function and quality of life. *Ann Thorac Surg* 1997 Jun;**63**(6):1568–72.
10. Bernhard J, Hurny C. Gastrointestinal cancer. In: Holland J, editor. *Psychooncology*. New York: Oxford University Press; 1998. p. 324–39.
11. Worster A, Sarco A, Thrasher C, Fernandes C, Chemeris E. Understanding the role of nurse practitioners in Canada. *Can J Rural Med* 2005;**10**(2):89–94.
12. Laurant M, Reeves D, Hermens R, Braspenning J, Grol R, Sibbald B. Substitution of doctors by nurses in primary care. *Cochrane Database Syst Rev* 2005(2):CD001271.
13. Verschuur EM, Kuipers EJ, Siersema PD. Nurses working in GI and endoscopic practice. a review. *Gastrointest Endosc* 2007 Mar;**65**(3):469–79.

14. Faithfull S, Corner J, Meyer L, Huddart R, Dearnaley D. Evaluation of nurse-led follow up for patients undergoing pelvic radiotherapy. *Br J Cancer* 2001;**85**(12):1853–64.
15. Helgesen F, Andersson SO, Gustafsson O, Varenhorst E, Goben B, Carnock S, et al. Follow-up of prostate cancer patients by on-demand contacts with a specialist nurse: a randomized study. *Scand J Urol Nephrol* 2000 Feb;**34**(1):55–61.
16. Loftus LA, Weston V. The development of nurse-led clinics in cancer care. *J Clin Nurs* 2001 Mar;**10**(2):215–20.
17. Moore S, Corner J, Haviland J, Wells M, Salmon E, Normand C, et al. Nurse led follow up and conventional medical follow up in management of patients with lung cancer: randomised trial. *Bmj* 2002;**325**(7373):1145.
18. Wallace MB, Kemp JA, Meyer F, Horton K, Reffel A, Christiansen CL, et al. Screening for colorectal cancer with flexible sigmoidoscopy by nonphysician endoscopists. *Am J Med* 1999 Sep;**107**(3):214–8.
19. Basnyat PS, Gomez KF, West J, Davies PS, Foster ME. Nurse-led direct access endoscopy clinics: the future? *Surg Endosc* 2002 Jan;**16**(1):166–9.
20. Niv Y, Niv G. Capsule endoscopy examination—preliminary review by a nurse. *Dig Dis Sci* 2005 Nov;**50**(11):2121–4.
21. Verschuur EML, Steyerberg EW, Tilanus HW, Polinder S, Essink-Bot ML, Tran TCK, et al. Nurse-led follow-up of patients after oesophageal or gastric cardia cancer surgery: a randomised trial. *Br J Cancer* 2009;**100**(1):70–6.
22. Dolan P. Modeling valuations for EuroQol health states. *Med Care* 1997 Nov;**35**(11):1095–108.
23. Aaronson NK, Ahmedzai S, Bergman B, Bullinger M, Cull A, Duez NJ, et al. The European Organization for Research and Treatment of Cancer QLQ-C30: a quality-of-life instrument for use in international clinical trials in oncology. *J Natl Cancer Inst* 1993;**85**(5):365–76.
24. Blazeby JM, Conroy T, Hammerlid E, Fayers P, Sezer O, Koller M, et al. Clinical and psychometric validation of an EORTC questionnaire module, the EORTC QLQ-OES18, to assess quality of life in patients with oesophageal cancer. *Eur J Cancer* 2003;**39**(10):1384–94.
25. Gold MR, Siegel JE, Russel LB, Weinstein MC. *Cost-effectiveness in health and medicine*. New York: Oxford University Press; 1996.
26. Drummond M, Sculpher M, Torrance G, O'Brien B, Stoddart G. *Methods for economic health care programmes*. 3rd ed. Oxford: Oxford University Press; 2005.
27. Efron B, Tibshirani RJ. *An introduction to the bootstrap*. London: Chapman and Hall; 1994.
28. Sahai AV. Cost-effectiveness studies in endoscopy: are they worth it? *Endoscopy* 2000;**32**(12):986–90.
29. McQuay H, Moore A. Need for rigorous assessment of palliative care. *Bmj* 1994;**309**(6965):1315–6.