Quality assurance for radical hysterectomy for cervical cancer: the view of the European Organization for Research and Treatment of Cancer—Gynecological Cancer Group (EORTC-GCG)

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Radical hysterectomy combined with a pelvic lymphadenectomy or chemoradiation are traditionally the mainstays of treatment of International Federation of Gynecology and Obstetrics (FIGO) stages Ia2–IIa cervical cancer. The quality of radical surgery for cervical cancer influences local tumor control and survival. Hence, it is important to optimize and ensure the quality of surgical care for cervical cancer patients. In this paper, we discuss factors that are related to outcome after radical hysterectomy and propose a set of quality indicators that can be used to audit and improve the quality of surgical care for cervical cancer patients.

Key words: quality assurance, radical hysterectomy, surgery, uterine cervical neoplasms

introduction

Surgery or chemoradiation are the mainstays of the treatment of cervical cancer International Federation of Gynecology and Obstetrics (FIGO) stages Ia2–IIa. When operated, these cancers are treated by radical hysterectomy and pelvic lymphadenectomy. During a radical hysterectomy, the whole uterus is removed together with the paracervical tissue and a vaginal cuff. The purpose of the operation is to remove the tumor with tumor-free margins, remove possible micrometastases, determine the lymph node status and aid tailoring of adjuvant treatment depending on prognostic factors. In this way, the quality of radical surgery for cervical cancer has an important influence on local control of the tumor and ultimately survival. Therefore, it is important to optimize and ensure the quality of surgical care for cervical cancer patients.

Quality assurance is an area of research that is engaged in evaluating and interpreting variations in treatment and linking them with treatment outcome in order to improve quality of care. The importance of quality assurance in surgical oncology has been repeatedly demonstrated for several tumor types but remains difficult due to the absence of quantifiable parameters and validated quality indicators [1].

*Surgical techniques and policies are often based on historical and local traditions rather than scientific evidence, as it is often considered a craft more than science. However, to be able to define, measure and ensure the quality of an operation, one has to identify issues crucial to achieve a set standard. For quality control, minimal standards of care need to be described, which then can be checked or audited in order to maintain this quality [2, 3].

In this paper, we discuss which factors influence the quality of a radical hysterectomy and pelvic lymphadenectomy and propose a set of quality indicators to audit and assure the quality of surgical care for FIGO stages I–IIa cervical cancer patients.

history of the radical hysterectomy

J. G. Clark of the Johns Hopkins Medical School was the first person to carry out and publish a description of a radical hysterectomy in 1895 [4–6]. E. Wertheim reported on his first 500 operations in 1912 and had his name assigned to the operation [5–7]. The goal of this extended hysterectomy with a broader resection of the parametria and a larger cuff of the vagina was to resect the cervical tumor with a margin of healthy tissue. The pioneers based their new techniques on careful study of removed specimens from hysterectomies already carried out at the time [4, 5]. Few years later, H. Okabayashi published his technique developed together with his teacher,
S. Takayama. Their technique includes the radical excision of the parametrial tissues and a wider dissection of the vesicouterine ligament with special attention for the posterior leaf [8, 9].

Halfway through the previous century, J. V. Meigs modified the technique and added elective pelvic lymphadenectomy as a routine part of the radical abdominal hysterectomy [10, 11].

More recently, the principle of removing the tumor with wide tumor-free margins and removing any micrometastases and primary stations of lymph drainage gained further support from pathological findings.

Burghardt et al. used the technique of giant sections. These whole organ subserial sections gave better insight into the anatomical relationship of the tumor and its environment. In their series of 359 investigated specimens, they found that spread of a cervical tumor into the parametria occurred in three different ways: direct growth of the primary tumor into the parametrium, involvement of parametrial lymph nodes and tumor emboli in the parametrial tissue without any relation to specific anatomical structure. Remarkably, both positive and negative nodes were found scattered irregularly throughout the parametria and often very close to the pelvic wall [4].

Benedetti-Panici et al., using a modified technique of giant sections, demonstrated parametrial lymph nodes in 93% of their patients. Both positive and negative nodes could be found in all ligaments examined, namely the superficial and deep layer of the anterior parametrium, lateral and lateral distal parametrium and uterosacral ligament. Thirty-six percent of the examined patients had positive lymph nodes, which could be found in all examined regions [12].

In 1974, Piver et al. published a classification of the radical hysterectomy, ranking extended hysterectomies in five classes of increasing radicality (Table 1) [13]. The indications for each class of radical hysterectomy were also specified in the original publication. The classification is still widely used but over time, discussions regarding anatomical definitions and clinical usefulness of particular steps of the operation have lead to inappropriate use of the terminology. New classifications to overcome the ambiguities are proposed and will be discussed later (Tables 2 and 3) [14, 15].

**variation in current practice**

Although techniques and classification of radical hysterectomy are long established, variability in pathological and clinical outcome remains.

Reported 5-year survival rates for patients with cervical cancer FIGO stage Ib range between 70% and 90% [6, 16, 17]. The number of cervical cancer patients receiving radiotherapy as part of their initial treatment differs widely between and within countries, rates from 20% to 50% being reported [18]. Also the frequency of short- and long-term complications after radical hysterectomy can differ significantly [6, 19, 20]. For example, the prevalence of functional disorders of the lower urinary tract is reported to be between 8% and 80% [21].

The interpretation of these variations is difficult as many factors (deep stromal invasion, lymphovascular space invasion and large tumor size) have been identified and have an influence on recurrence and survival rates, independent of the treatment given [22–25]. How frequently radiotherapy and/or chemotherapy is used depends not only on case mix but also on the locally accepted indications for adjuvant therapy [18]. Apart from the actual difference in number of complications, reported figures will also depend on the accuracy of reporting and the way of defining and measuring the complications [19].

Furthermore, differences in the surgery carried out can correlate with differences in outcome. Girardi et al. [26] increased the percentage of patients with positive parametrial nodes from 10% to 24% and the number of patients with positive pelvic lymph nodes from 33% to 55% by using a more extensive procedure with a more radical resection of both the parametrium and the pelvic lymph nodes. Trimbos et al. saw a significantly higher number of removed lymph nodes and a trend of better survival as their surgical skills improved with experience, in spite of no change in the distribution of other prognostic factors [27].

Removing the parametria and the upper vagina and pelvic lymphadenectomy are considered the essential steps of a radical

<table>
<thead>
<tr>
<th>Class</th>
<th>Description</th>
</tr>
</thead>
<tbody>
<tr>
<td>I</td>
<td>Extrafascial hysterectomy</td>
</tr>
<tr>
<td>II</td>
<td>Modified radical hysterectomy</td>
</tr>
<tr>
<td>III</td>
<td>Classical Meigs’ radical hysterectomy</td>
</tr>
<tr>
<td>IV</td>
<td>More radical than class III in three aspects:</td>
</tr>
<tr>
<td>V</td>
<td>More radical than class IV:</td>
</tr>
</tbody>
</table>

**Table 1. Classification of radical hysterectomy according to Piver, Rutledge and Smith [13]**
hysterectomy and are perceived to have the most impact on outcome. However, in the past decade, the indications for and required extent of parametrectomy were being actively investigated and discussed [7, 28, 29]. For patients with small tumors, the risk of parametrial disease is low [7] and the opinion gaining support is to treat these patients with a modified radical hysterectomy or even with less radical procedures such as cone biopsy or simple hysterectomy to avoid morbidity [30]. Also the use of neoadjuvant chemotherapy to limit the need for radical surgery is currently under investigation [31, 32].

Furthermore, a randomized controlled trial comparing Piver–Rutledge–Smith class II with class III radical hysterectomy in FIGO stage Ib–IIa cervical cancer showed that both were equally effective if patients receive postoperative radiotherapy when risk factors were present [33]. However, postoperative radiotherapy was used at a high frequency in the trial casting doubt on the results. Also the trial was underpowered to detect small differences in survival [34]. In view of these limitations of the study, type III radical hysterectomy is still advised for FIGO stage Ib–IIa cervical cancer [14].

Other investigators have tried to optimize the risk–benefit ratio of radical hysterectomy by detailed study of the anatomy of the female pelvis with emphasis on the parametrial, paracervical and neurological tissues [35–38]. During nerve-sparing surgery, the hypogastric nerves and the pelvic splanchnic plexus are identified and freed before the procedures such as cone biopsy or simple hysterectomy to avoid morbidity [30]. Also the use of neoadjuvant chemotherapy to limit the need for radical surgery is currently under investigation [31, 32].

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### Table 2. Classification of radical hysterectomy adopted by the EORTC-GCG [14]

<table>
<thead>
<tr>
<th>Type</th>
<th>Description</th>
</tr>
</thead>
<tbody>
<tr>
<td>I</td>
<td>Simple hysterectomy</td>
</tr>
<tr>
<td>II</td>
<td>Modified radical hysterectomy</td>
</tr>
<tr>
<td></td>
<td>Ureters dissected to the point of their entry to the bladder</td>
</tr>
<tr>
<td></td>
<td>Proximal uterosacral ligaments resected</td>
</tr>
<tr>
<td></td>
<td>Medial half of the cardinal ligaments removed</td>
</tr>
<tr>
<td></td>
<td>1–2 cm of upper vagina removed</td>
</tr>
<tr>
<td>III</td>
<td>Radical hysterectomy</td>
</tr>
<tr>
<td></td>
<td>Removal of as much of the uterosacral ligaments as possible</td>
</tr>
<tr>
<td></td>
<td>Entire width of the parametra is resected</td>
</tr>
<tr>
<td></td>
<td>Upper third of the vagina is removed</td>
</tr>
<tr>
<td>IV</td>
<td>Extended radical hysterectomy</td>
</tr>
<tr>
<td></td>
<td>As type III but three-quarters of the vagina and paravaginal tissue is removed</td>
</tr>
<tr>
<td>V</td>
<td>Partial exenteration</td>
</tr>
<tr>
<td></td>
<td>The terminal ureter or a segment of the bladder or rectum is removed along with the uterus and parametria (supravelvontal)</td>
</tr>
</tbody>
</table>

Types II–V hysterectomies are completed with a systematic bilateral pelvic lymphadenectomy, half the way along the common iliac artery down to the femoral ring, including the presacral, both external and internal, interiliac and the obturator nodes. Removal of the tubes and ovaries is not part of radical hysterectomy per se.


### Table 3. Classification of radical hysterectomy according to Querleu and Morrow [15]

<table>
<thead>
<tr>
<th>Type</th>
<th>Description</th>
</tr>
</thead>
<tbody>
<tr>
<td>A</td>
<td>Extrafascial hysterectomy</td>
</tr>
<tr>
<td></td>
<td>Visualization and/or palpation of the ureters without dissection of the ureteral bed</td>
</tr>
<tr>
<td></td>
<td>Uterine artery, uterosacral ligament and cardinal ligament are not transected at a distance from the uterus</td>
</tr>
<tr>
<td></td>
<td>Minimal vaginal cuff removed (&lt;10 mm)</td>
</tr>
<tr>
<td>B</td>
<td>Ureters are unroofed and rolled laterally</td>
</tr>
<tr>
<td></td>
<td>Partial removal of uterosacral and vesicouterine ligaments</td>
</tr>
<tr>
<td></td>
<td>Transection of the paracervix at the level of the ureteral tunnel</td>
</tr>
<tr>
<td></td>
<td>At least 10 mm of the vagina from the cervix or tumor is resected</td>
</tr>
<tr>
<td></td>
<td>Type B1: without removal of lateral paracervical lymph nodes</td>
</tr>
<tr>
<td></td>
<td>Type B2: with additional removal of lateral paracervical lymph nodes</td>
</tr>
<tr>
<td>C</td>
<td>Ureters are completely mobilized</td>
</tr>
<tr>
<td></td>
<td>Transection of the uterosacral ligament at the rectum</td>
</tr>
<tr>
<td></td>
<td>Transection of the vesicouterine ligament at the bladder</td>
</tr>
<tr>
<td></td>
<td>Complete transection of the paracervix</td>
</tr>
<tr>
<td></td>
<td>15–20 mm of the vagina from the cervix or tumor and the corresponding paracolpos is resected routinely</td>
</tr>
<tr>
<td></td>
<td>Type C1: with preservation of autonomic nerves</td>
</tr>
<tr>
<td></td>
<td>Type C2: without preservation of autonomic nerves</td>
</tr>
<tr>
<td>D</td>
<td>Ureters are completely mobilized</td>
</tr>
<tr>
<td></td>
<td>Transection of the uterosacral ligament at the rectum</td>
</tr>
<tr>
<td></td>
<td>Transection of the vesicouterine ligament at the bladder</td>
</tr>
<tr>
<td></td>
<td>Complete transection of the paracervix</td>
</tr>
<tr>
<td></td>
<td>15–20 mm of the vagina from the cervix or tumor and the corresponding paracolpos is resected routinely</td>
</tr>
<tr>
<td></td>
<td>Type D1: resection of the entire paracervix at the pelvic side wall together with the hypogastric vessels, exposing the roots of the sciatic nerve</td>
</tr>
<tr>
<td></td>
<td>Type D2: type D1 plus resection of the entire paracervix with the hypogastric vessels and adjacent fascial or muscular structures</td>
</tr>
</tbody>
</table>

For all types, lymphadenectomy is described separately according to four levels (external and internal iliac, common iliac, aortic inframesenteric and aortic infrarenal) and radicality (sentinel node sampling, random sampling, removal of enlarged nodes only, systematic lymph node dissection or debulking).
surgery is objectively standardized, easily reproducible and of clinical trials investigating this are underway. These studies will only be discussed in the gynecologic oncology community and several optimal patient outcome parameters. Indications, radicality should be made to deliver high-quality surgery to ensure quality assurance and standardization of adjuvant therapy, overall morbidity, local tumor control and the number of perioperative complications, the appropriateness of remaining lymph nodes. As such, conclusions regarding the possible risks of only selective removal of lymph nodes do not clearly emerge from the study [44, 45].

On the other hand, Kenter et al. retrospectively reviewed 63 cervical cancer patients with nodal involvement and found that patients who underwent a complete lymphadenectomy (defined as lymphatic tissue removed from minimum five out of six pelvic lymph node stations) had a better survival than those with an incomplete lymphadenectomy. All patients received adjuvant radiotherapy regardless of the completeness of the lymphadenectomy [46].

The better survival of node-positive patients, if a higher number of lymph nodes are removed, has been confirmed in another study by the same center [47].

Recently, for various cancer types, e.g. breast cancer, colon cancer, ovarian cancer and endometrial cancer, a positive relationship between survival and the number of removed lymph nodes has been shown, using data from a large population-based database [48–51]. Such large-scale evidence is not available for cervical cancer, hence, the ongoing discussion about the therapeutic benefit of systematic lymphadenectomy for cervical cancer [52].

The clinical usefulness and feasibility of sentinel node sampling is under investigation in cervical cancer surgery. Apart from the identification of patients who can be spared from pelvic lymphadenectomy if the sentinel node is negative, the detection of micrometastases using serial sectioning and immunohistochemistry has also reinforced the value of complete pelvic lymphadenectomy for cervical cancer [53].

All these long-standing discussions and new developments further promote variance in practice although strong evidence showing influence on outcomes is still lacking. There is a strong need for further research to clarify the issues on radicality.

quality assurance and standardization

It is clear that the extent and the quality of surgery influences the number of perioperative complications, the appropriateness of adjuvant therapy, overall morbidity, local tumor control and consequently probably survival. Therefore, all possible efforts should be made to deliver high-quality surgery to ensure optimal patient outcome parameters. Indications, radicality and new techniques for radicality are currently under discussion in the gynecologic oncology community and several trials investigating this are underway. These studies will only be able to produce reliable and easily interpretable results if the surgery is objectively standardized, easily reproducible and of good quality.

Measures to improve the quality of care in daily practice and in clinical trials are related to structure, outcome and process [55]. Based on the review of available literature, the European Organization for Research and Treatment of Cancer—Gynecological Cancer Group (EORTC-GCG) now proposes quality indicators for radical hysterectomy and pelvic lymphadenectomy for these three domains. The proposed set of quality indicators are summarized in Table 4.

quality assurance on a structural level

Structural quality indicators describe the type and amount of resources used to deliver care and they relate to the presence or number of staff, patients, money, beds, supplies and buildings [55]. In general, the literature supports a positive relationship between number of cases operated on and outcome for different types of cancer, indicating a benefit for centralization of care pathways [56].

Monaghan et al. [57] strongly indicated centralization of radical surgery for cervical cancer based on the treatment outcomes in their center. At the University of Leiden, a learning curve in carrying out radical hysterectomies was clearly demonstrated. The same surgical team achieved better results for several surgical parameters and even a trend of better survival was observed at the end of a 13-year period [27]. Recently published single-center results confirm that abdominal radical hysterectomy can be carried out with excellent outcome parameters by an experienced team [58].

Also for the introduction of newer techniques, e.g. laparoscopic and robotic radical hysterectomy, learning curves have been described, further promoting the case for centralization [59, 60].

Considering the declining incidence of cervical cancer in Northern America and Western Europe, there is an argument for centralizing its surgical care to make sure gynecological oncologists treat sufficient cases and have the necessary skills to deliver optimal patient outcome in terms of survival and morbidity.

quality assurance using outcome indicators

Outcome measures are indicators of the total health of treated patients and are valid as indicators of the quality of given care as far as health is influenced by it. Health and outcome of care will also be determined by patient characteristics, stage and biology of the disease. Furthermore, random chance and differences in the way of collecting data will influence the crude outcome figures. These confounding factors can be accounted for by using a large sample size, risk adjustment and statistical significance testing [61]. Risk-adjusted outcome indicators of quality are often used by health care insurers, governments and financiers [55].

In surgery, the most developed quality assurance project based on risk-adjusted outcome parameters is the National Surgical Quality Improvement Program (NSQIP) initiated by the American College of Surgeons. After implementation in the Veterans Administration hospitals, 30-day mortality rates after major surgical procedures decreased by 31% and the 30-day morbidity rate by 45% [62]. The NSQIP
methodology was successfully implemented in the quality assessment of ovarian cancer surgery [63], but risk-adjusted benchmarks for outcome after radical hysterectomy are not available yet.

At present, one of the best available benchmarks for outcome indicators after radical hysterectomy is extracted from an international trial investigating the clinical significance of surgical drainage following radical hysterectomy [64]. These data are not risk adjusted but as they represent current practice in an international trial and for a large sample size, they can be considered the standard of care and as such be useful in future quality assurance projects [64].

**quality assurance using process indicators**

Process indicators refer to specific actions that lead to a high likelihood of favorable outcome.

They provide an answer to the question of what a care provider has to do to deliver high-quality treatment. Process indicators are very useful for health care providers when taking initiatives to improve the quality of care within their department [61].

A radical hysterectomy, still considered standard treatment of stages IB and IIA cervical cancer, will be considered of high quality if it provides a wide excision of the tumor and removes areas of possible micrometastases, resulting in good local control and a favorable morbidity profile.

The technique to carry out a type II or type III radical hysterectomy is considered standardized in the classification of Piver–Rutledge–Smith (Table 1). However, Hoffman [28] reviewed how a Piver–Rutledge–Smith type II or type III radical hysterectomy was described in different trial reports and noticed significant differences. Some centers have developed new techniques to remove the parametria more completely, indicating that radicality can even differ within the group of type III Piver–Rutledge radical hysterectomies [65–67]. The classification does not achieve clear and objective standardization of the different steps of the operation because of various reasons. It does not refer to clear anatomical landmarks and the original classification has been changed in time by oral tradition and inaccurate use [14, 15].

The need for better standardization and a more objective classification has been recognized and led to proposals of a revised classification developed by the EORTC-GCG and by Querleu and Morrow [14, 15]. Both classifications attempt to better standardize the procedure and make the classification more clinically relevant and are based on well-defined anatomical landmarks (Tables 2 and 3). The use of internationally accepted anatomical terms makes comparison of procedures and outcomes possible, under the conditions that techniques and measurements are well documented in the operation reports.

Another proposed way to objectively assess the radicality of an operation is to measure the length of removed parametrial tissue and vaginal cuff. This method has previously been used when comparing laparoscopic and open techniques and is advised by the international panel who proposed a new classification of radical hysterectomy [15]. Hoffman et al. measured the total length of the parametria and the length of the part to be removed while cardinal ligaments and uterosacral ligaments were still in situ [68]. If measurement methods appear to be reproducible by different investigators, it would be a good method to standardize radicality of parametrectomy in

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**Table 4. Quality indicators for radical hysterectomy and pelvic lymphadenectomy proposed by the EORTC-GCG**

<table>
<thead>
<tr>
<th>Quality indicator</th>
<th>Accepted standard</th>
</tr>
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<tbody>
<tr>
<td><strong>Structure</strong></td>
<td></td>
</tr>
<tr>
<td>Number of radical hysterectomies by surgeon per year</td>
<td>≥10</td>
</tr>
<tr>
<td>Number of radical hysterectomies by institution per year</td>
<td>≥20</td>
</tr>
<tr>
<td><strong>Outcome</strong></td>
<td></td>
</tr>
<tr>
<td>Five-year survival of cervical cancer patients having received radical hysterectomy (FIGO stages I–IIa)</td>
<td>≥80%</td>
</tr>
<tr>
<td>Percentage of cervical cancer patients suffering pelvic recurrence after radical hysterectomy for cervical cancer</td>
<td>≤15%</td>
</tr>
<tr>
<td>Percentage of patients having short-term complications after radical hysterectomy</td>
<td></td>
</tr>
<tr>
<td>Postoperative mortality</td>
<td>≤1%</td>
</tr>
<tr>
<td>Postoperative hemorrhage</td>
<td>≤1%</td>
</tr>
<tr>
<td>Urinary tract injury</td>
<td>≤1%</td>
</tr>
<tr>
<td>Bowel obstruction</td>
<td>≤1%</td>
</tr>
<tr>
<td>Deep venous thrombosis</td>
<td>≤3%</td>
</tr>
<tr>
<td>Percentage of patients having long-term complications after radical hysterectomy</td>
<td></td>
</tr>
<tr>
<td>Symptomatic lymphocysts</td>
<td>≤5%</td>
</tr>
<tr>
<td>Ureteral stenosis</td>
<td>≤5%</td>
</tr>
<tr>
<td>Incisional hernia</td>
<td>≤5%</td>
</tr>
<tr>
<td>Fistula requiring surgery (vesico-, uretero- or rectovaginal)</td>
<td>≤5%</td>
</tr>
<tr>
<td>Percentage of radical hysterectomy specimens with tumor-positive resection margins</td>
<td>≤5%</td>
</tr>
<tr>
<td><strong>Process</strong></td>
<td></td>
</tr>
<tr>
<td>Percentage of surgery reports that contain information on mode of access, radicality of the different steps of the operation and completeness of lymphadenectomy</td>
<td>≥95%</td>
</tr>
<tr>
<td>Percentage of pelvic lymphadenectomy specimens that contain &gt;11 examined lymph nodes</td>
<td>≥90%</td>
</tr>
<tr>
<td>Percentage of pelvic lymphadenectomy specimens that contain at least one examined lymph node in each common iliac, external and internal iliac and obturator area</td>
<td>≥95%</td>
</tr>
<tr>
<td>Percentage of radical hysterectomies without peritoneal closure and retroperitoneal drainage</td>
<td>≥95%</td>
</tr>
<tr>
<td>Percentage of patients undergoing radical hysterectomy who receive adequate administration of perioperative antibiotics</td>
<td>≥95%</td>
</tr>
<tr>
<td>Percentage of patients starting normal diet on day 1 after a radical hysterectomy</td>
<td>≥90%</td>
</tr>
</tbody>
</table>

clinical trials. Radicability can then be defined as the proportion or length of the ligaments removed.

Extent of lymphadenectomy is traditionally measured using the number of lymph nodes removed. The number of lymph nodes will be determined not only by the extent of the surgery, but also by anatomic variance and completeness of the pathological examination [47]. Thus, a low number of lymph nodes is not necessarily the result of poor quality surgery.

On the other hand, one can say that a sufficient number of lymph nodes does reflect a minimum standard of surgical and anatomicopathological practice and so can be used as a quality requirement in clinical trials. How to define the minimum number of pelvic lymph nodes to be removed in order to call a pelvic lymphadenectomy adequate is an unresolved issue. The EORTC-GCG agreed that the minimum number of pelvic lymph nodes that must be removed is 12 [14]. According to the International Union against Cancer, a minimum of 10 lymph nodes should be investigated for the determination of pN0 [69].

Assessing the quality of lymphadenectomy can also be achieved by checking the presence or absence of lymph nodes in separate predefined regions, a way of quality control used by Bonenkamp et al. [70] in a surgical trial for gastric cancer. The Association of Directors of Anatomic and Surgical Pathology recommends reporting of the total number of involved lymph nodes in relation to the total number of lymph nodes identified in each submitted group of lymph nodes [71].

Radicability of the parametrectomy and lymphadenectomy are considered the essential steps of a radical hysterectomy to assure local control of the tumor. However, in terms of morbidity, other perioperative factors are as important.

Traditionally, a radical hysterectomy is carried out through a vertical midline incision to have good access to lymph node areas and to make a proper assessment of the whole abdomen possible [5, 72]. In retrospective reviews, transverse incisions (Pfannenstiel and Maylard) have been associated with fewer complications, reduced operative time and shorter hospital stays without compromising the number of lymph nodes removed [73–76] but no randomized study or international agreement is available to aid the choice of incision. Newer methods of gaining access are under development.

Laparoscopic and robotic radical hysterectomies have been shown to be feasible and safe and are probably associated with a shorter operation time, less blood loss and a better quality of life. These techniques will be further evaluated for perioperative morbidity and oncolgic safety [59, 60].

The use of peritoneal closure and retroperitoneal drainage has been abandoned since randomized trials have shown a trend of decreased perioperative morbidity and symptomatic lymphocysts when the peritoneum is left open and no drains are used [77, 78].

Two small but randomized studies have demonstrated that an early bowel stimulation and feeding protocol reduces the duration of postoperative ileus and hospital stay [79, 80].

It is generally accepted that prophylactic antibiotics should be given to reduce infectious morbidity after radical hysterectomy [81, 82]. Single-dose administration appears to be sufficient [83]. A program to ensure adequate administration of perioperative antibiotics in gynaecological oncology patients resulted in a decrease of surgical site infections [84].

conclusion

The technique and classification of radical hysterectomies is historically well developed and described. However, data in the literature indicate that variety in radicability and quality still exists and has an influence on oncologic outcome and morbidity. In spite of the scarcity of evidence, factors that are related to better outcome can be identified.

The quality of a radical hysterectomy can be improved by centralization of cervical cancer surgery assuring a sufficient number of operations per surgeon.

Monitoring outcome parameters like local recurrence rate, survival and short- and long-term morbidity can identify areas to be improved in comparison with the international state-of-the-art treatment. Lymph node count can be used as a quality assurance tool and precise definition and description of the radicability of an operation will improve standardization.

Furthermore, randomized trials have shown that the omission of peritoneal closure and retroperitoneal drainage and early bowel stimulation have a beneficial influence on perioperative morbidity.

By defining quality indicators for radical hysterectomy as summarized in Table 4, the EORTC-GCG offers a tool to assess the quality of surgery for cervical cancer patients in order to further investigate the impact of surgical care on outcome and to optimize the quality of care for these patients.

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