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Review

Does the use of epidural analgesia in open gynaecological oncology surgery impact patient outcomes. A Narrative Review

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Abstract

The use of epidural analgesia (EA) for major open gynaecological oncology surgery remains controversial. While it is generally regarded as providing optimal pain relief compared to systemic opioids, the associated complications, adverse events, and technical issues are cause for concern. Furthermore, there is evidence to suggest that EA hampers early mobilisation, potentially increasing length of stay (LOS).
The recent Enhanced Recovery After Surgery (ERAS) guidelines for gynaecological oncology surgery from April 2023 prefer alternative strategies for pain relief such as wound infiltration. The main reason is fear of significant complications associated with neuraxial analgesia.
We included all articles published between 2000 and 2023 using the search terms epidural' 'gynaecology' 'oncology' 'surgery'. Our current literature search aimed to identify the most robust evidence regarding the use of EA in gynaecological surgery. We sought to evaluate a comprehensive assessment of efficacy, safety, and overall impact on patient outcomes of EA in gynaecological surgery. This effort was focused on understanding the nuances of how EA performs in this specific context and how it compares to other pain management strategies.
Despite our comprehensive search, most of the data remains inconclusive, and there is significant discrepancy among studies and guidelines. This inconsistency underscores the need for further research to clarify the effectiveness and safety of EA in open gynaecological surgery. The conflicting evidence highlights the challenges in establishing a consensus and suggests that current recommendations may not fully capture the complexities of its clinical use in this specific setting. More research regarding complication and success rates as well as considering potential benefits in specific patient populations are needed.

Introduction

EA has been used in clinical practice for more than 120 years[1]. It wasn't until after the second world war however, that the use of EA grew exponentially[2]. Today EA has a wide range of uses, including for pain relief during labour and for major open surgery like thoracotomies and laparotomies[3,4].

The mechanism of EA is straightforward and accounts for its highly effective pain control. Local anaesthetics (LA) are injected into the epidural space and surround the spinal nerve roots. This disrupts conduction of stimuli along the spinal cord. Dependent on the volume and concentration of LA, sympathetic B fibres, A beta fibres responsible for touch and pressure, A delta and C fibres responsible for pain and temperature sensation and A alpha motor fibres will be affected. While this results in effective pain relief, it can also lead to some adverse effects such as hypotension and motor block leading to reduced mobilisation and rarely can have serious complications, for example, post dural puncture headache (PDPH) epidural abscess or epidural haematoma[5-7].

The placement of an epidural catheter before major open abdominal surgery, including gynaecological cancer procedures, remains common practice in many centres. However, this approach is increasingly subject to debate. Studies across the developed world show a downward trend in the use of EA with a reduction up to 50%[6-11]. According to both the Enhanced Recovery

After Surgery (ERAS) and Procedure Specific Post-operative Pain Management (PROSPECT) guidelines, EA is still the gold standard in open colorectal surgery[12,13]. However, gynaecological cancer surgery is often very complex, involving both the abdomen and pelvis. Guidelines concerning EA for these procedures do not concur with those for open colorectal surgery. EA is widely believed to offer superior pain relief and may even reduce post-operative ileus, blunt an exaggerated inflammatory response and reduce respiratory complications. However, concerns persist about the frequency of failed blocks and the potential delay in early mobilization. This delay could, in turn, lead to longer hospital stays, increased morbidity, and higher mortality rates[14-27].

The ERAS guidelines on gynaecological surgeries do not support EA[13]. Instead they favour potentially safer techniques like Transverse Abdominis Plane blocks (TAP) or plain surgical wound infiltration (SWI). These guidelines, however, are based on all gynaecologic oncology surgery, including laparoscopic interventions, and are not specific for major open interventions. Hence the discussion remains: does EA offer advantages in open, major gynaecological interventions and is the risk benefit balance in favour of EA.

Therefore, this narrative review aims to summarise the current body of evidence which considers both the benefits and risks of EA for open gynaecological cancer surgery. We aim to provide an up-to-date analysis and a practical guide to assist in current clinical decision making.

Methods

A literature search of PubMed, Cochrane and Embase was conducted looking at results publish between the January 2000 until November 2023 with the search terms ‘open’, ‘epidural’ ‘gynaecology’ ‘oncology’ ‘surgery’. Only results published in English were considered for this narrative review. After screening the abstracts, relevant articles were read in full to allow for further filtration. Finally, 18 were deemed relevant for inclusion in this narrative review. In addition, any relevant references found from articles from the literature search were also included. (See Fig. 1 for PRISMA chart)

The targeted population comprised of women over the age of eighteen who had undergone open gynaecological surgery for oncological reasons. We assessed and compared post-operative pain management using an epidural catheter versus intravenous (IV), subcutaneous (SC), or oral opioids. A wide range of outcomes were included; pain, post-operative nausea and vomiting (PONV), urinary retention/catheter use, venous thromboembolism (VTE), cancer recurrence, wound complications, blood loss and length of stay (LOS).

Results

Pain

Table I shows the results of studies comparing IV opioids versus EA. Several studies suggest that patient controlled epidural analgesia (PCEA) provides superior postoperative pain management

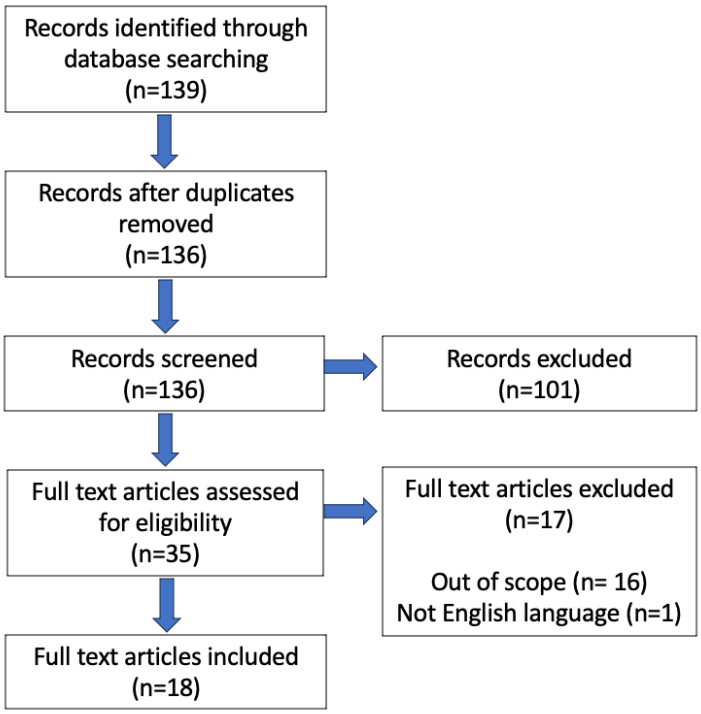

Fig. 1 — PRISMA chart.

compared to IV opioids. A prospective randomised trial by Ferguson et al found that PCEA offers superior postoperative pain control at rest on the first postoperative day, and on coughing for the first three postoperative days compared to parenteral opioids. The mean VAS (Visual Analogue Scale) VAS score at rest on day 1 was 3.3 for the PCEA group compared to 4.3 for the group receiving IV opioids (P=0.01)[14]. Similarly, a number of cohort studies found that the use of PCEA after laparotomy for gynaecological cancer was associated with decreased IV and oral narcotic use and improved pain control[15-18]. Additionally, a study by Moslemi et al. found no significant difference in pain at rest between groups, but pain on first mobilization was significantly lower in the PCEA group (VAS: 1.89 ± 0.93 vs. 2.67 ± 0.02, p<0.001)[17].

Some papers however found no superiority of EA for postoperative pain relief, with one study by Chen et al finding that patients who received PCEA required more supplemental pain medications than those patients receiving opioid based analgesia (See Table I)[19,20].

Cancer recurrence

Table II summarises the results of 7 retrospective cohort studies which compared the outcomes of patients with gynaecological malignancies who received EA compared to opioids post operatively[21-27]. Of the 7 studies, 4 found improved overall survival (OS) or progression free survival (PFS) in the epidural arm and 3 found there to be no significant difference, with 1, a study by Capmas et al, finding a trend towards improved PFS in the EA-group. However, this failed to reach significance and lacked statistical power[27].

Complications

The NAP 3 study from the UK published in 2009 was one of the biggest of its kind and looked at complications following central neuraxial blocks and included spinals, epidurals, combined spinal/epidural (CSE) and caudal blocks. In total, 293,000 epidurals were logged, nearly 98,000 of which were for perioperative reasons (not including obstetrics). When looking only at the epidural cohort, they documented 5 epidural abscesses, no cases of meningitis and 5 cases of haematoma. This puts the risk of abscess and haematoma in the region of 1 in 60,000[28]. Two smaller studies found a significantly higher risk of complications. A study spanning six years by Christie et al. from 2007 which included 8100 patients who received an epidural, found 6 cases of epidural abscess, 3 of meningitis and 3 of epidural haematoma[8]. That equates to an incidence of 1 in 1350 when considering epidural abscess

Table I. — Studies comparing the efficacy of EA compared to IV opioids in management of postoperative pain.

Reference	Study Type	No. of patients	Epidural regimen	Comparator	Outcome	Comments
Ferguson SE et al.[14]	Prospective RCT*	135	Bupivacaine + fentanyl	Morphine PCA	EA patients had lower VAS** scores at rest on D1 and on coughing on D1,2 and 3.	
Huepenbecker et al.[15]	Retrospective cohort study	561	Bupivacaine 0.1%	Hydromorphone PCA	EA patients used less opioids post op and had improved NRS***	No data on EA use intra-op
Courtney-Brooks et al.[16]	Retrospective cohort study	237	Unclear	'Opioid' PCA	Patients with EA had lower VAS scores for the first 3 days	No data on EA use intra-op
Moslemi et al.[17]	RCT	90	Bupivacaine + fentanyl	Fentanyl PCA	Lower VAS scores on mobilisation with EA	Pain at rest was not significantly different
Rivard et al.[18]	Retrospective cohort study	112	Bupivacaine 0.125% or 0.0625% + hydromorphone 3–6 mg ml^{-1}	PCA vs PCA + TAP	EA lower NRS scores and less narcotic pain meds on D1 and 2	TAP arm less narcotic use D0
Elit et al.[19]	Retrospective cohort study	219	Bupivacaine +/- fentanyl	Morphine PCA	No significant difference in NRS scores	EA produced more problems with delivery of analgesia compared to PCA
Chen et al. [20]	Prospective cohort study	205	Ropivacaine 0.125% + 2µg ml^{-1} fentanyl	Hydromorphone PCA	No significant difference in VAS pain scores	EA cohort required more supplemental pain medication

* RCT (Randomised control trial); **VAS (Visual analogue scale); *** NRS (Numeric rating scale).

Table II. — Retrospective cohort studies comparing the effects EA to systemic opioids on recurrence of cancer and survival.

Reference	No. of patients	Epidural regimen	Comparator	Outcome	Comments
Tseng et al.[21]	648	Bupivacaine 0.05% +/- opioid (started either intra or post op)	'Narcotic containing' PCA	Increased PFS and OS	Significantly higher staged cancer and incidence of carcinomatosis in epidural arm
Lin et al.[22]	143	Bupivacaine 0.125% or ropivacaine 0.15% with 6-8mg morphine over 48hrs (Started pre incision)	Fentanyl PCA	Better 3 and 5 yr survival	High numbers of patients lost to follow up
Elias et al.[23]	194	PCEA with bupivacaine +/- hydromorphone (depending on age) (Unclear if started peri op or post op)	Unclear	Increased DFS	Result only significant in subgroup analysis.
de Oliveira et al.[24]	127	Bupivacaine 0.1% + hydromorphone (Started either intra or post op)	Hydromorphone PCA	Increased PFS with EA	Only significant for EA used intra-op
Anic et al.[25]	110	PCEA with bupivacaine 0.125% +/- fentanyl (Started intra op)	Piritramide PCA	No significant difference in PFS or OS	Maintenance of anaesthesia not uniform. Either via 'balanced anaesthesia' or TIVA
Lacassie et al.[26]	80	(Started intra op if haemodynamics allowed)	Morphine PCA	No significant difference in PFS or OS	
Capmas et al.[27]	104	Bupivacaine 0.2% + morphine	Unclear	No significant difference in OS	Trend in favour of PCEA for disease free survival.

*TIVA (Total intravenous anaesthesia).

and 1 in 2700 when considering meningitis and haematomas. A similar study in Australia from the same year looking at 8210 patients who received epidurals for postoperative analgesia found similar results; in total 6 abscesses and 2 haematomas[11].

The NAP 3 study found 3 cases of nerve injury from the 293,000 patients who received an epidural. Considering all documented complications, the data were manipulated to calculate pessimistic and optimistic predictions about the incidence of permanent injury and paraplegia or death, specifically for perioperative epidurals. They found an incidence of 8.2 to 17.4 cases of permanent injury, per 100,000 epidurals and between 1 and 6.1 cases of paraplegia or death per 100,000 people[28].

Adverse effects

A large retrospective study by Ackroyd et al. of 4070 patients found an increased risk of 30-day complications (75.9% vs 62%) and an increased LOS in patients who received EA[29]. Complications included; blood transfusion, cerebrovascular accident, myocardial infarction, wound disruption, surgical site infection, deep venous thromboembolism, pulmonary embolism, sepsis, pneumonia, urinary tract infection, intestinal obstruction, prolonged nasogastric tube use or nil per os, prolonged ventilation or unplanned re-intubation. Specifically, they found a significantly higher rate of blood transfusion, wound disruption, surgical site infection and ileus in the EA group. In contrast however, a similar study by Heupenbecker et al. from 2019 of 561 patients, identified the opposite. In their study, a lower incidence of wound complications (5% vs 14.1%) and a shorter LOS were observed in the EA group compared to the group who received a hydromorphone PCA[15].

Both groups agree that the incidence of VTE is not significantly different between patients receiving EA compared to those managed with opioids. Nonetheless, a study by Courtney-Brooks et al. found a significantly higher incidence of VTE in patients who received EA; 8.9% vs 1.7%, p=0.02[16].

Most studies reveal a lower incidence of nausea, vomiting and ileus when utilising EA as part of a multimodal approach. De Leon-Casaola et al. found that patients who received EA tolerated foods sooner than the group who received IV morphine; 6 ± 2 versus 11 ± 3 days respectively, p<0.0001, and required half as many days of nasogastric therapy as the non-epidural group[30]. Elit et al. found that the epidural group experienced less nausea than the PCA group[19]. Other studies by; Fergusen, Moslemi and Rivard et al. have found no difference in the incidence of PONV and ileus[14,17,18]. As mentioned above, Ackroyd et al. conversely found the time

before return of bowel function was longer in the EA group than the PCA group; 12.3% vs 9.3%, p<0.05[29].

Urinary retention was also investigated in many of the studies. Although no difference in incidence was found in epidural vs opioid cohorts by either Rivard or Ackroyd, numerous studies have reported longer durations of urinary catheterisation in patients who received EA in comparison to IV opioids[15,16,19].

Relatively few studies have investigated the effect of EA on respiratory complications. Ackroyd et al. found no difference in the incidence of pneumonia between the two cohorts[29]. Although Ferguson et al. showed a reduction in pain on coughing in the epidural group, the clinical significance in terms of respiratory complications was not studied[14]. Moselimi et al found that the level of sedation was significantly higher in the IV analgesia group (p<0.001) and that the incidence of respiratory depression tended towards also being higher in this group, however this difference did not reach significance (p=0.11)[17].

See Table III for a summary of the evidence relating to specific adverse events, including incidence of VTE, PONV and ileus, urinary retention and respiratory complications[14-19, 29,30].

Discussion

There is a good body of evidence which suggests that a well-functioning epidural provides

Table III. — Summary of studies comparing the incidence of adverse effects in patients receiving EA versus opioid based analgesia.

Adverse event	Reference	No. of patients	Disease type	Outcome	Comments
VTE	Huepenbecker et al.[15]	561	Benign and malignant	No significant difference	Significantly more patients with benign disease received EA
	Courtney-Brooks et al.[16]	237	Benign and malignant	Higher incidence in EA arm	
	Ackroyd et al.[29]	4070	Benign and malignant	No significant difference	
Nausea/ vomiting/ ileus	Ferguson et al.[14]	135	Benign and malignant	No significant difference	
	Moslemi et al.[17]	90	Disease not mentioned	No significant difference	
	Rivard et al.[18]	112	Benign and malignant	No significant difference	
	Elit et al.[19]	219	Malignant only	Less nausea in EA arm	
	Ackroyd et al.[29]	4070	Malignant only	Ileus longer in EA arm	
	de Leon-Casasola et al.[30]	68	Malignant only	EA arm tolerated food sooner and required less NG therapy	
Urinary retention	Huepenbecker et al.[15]	561	Benign and malignant	Longer duration of urinary catheterisation	Significantly more patients with benign disease received EA
	Courtney-Brooks et al.[16]	237	Benign and malignant	Longer duration of urinary catheterisation	
	Rivard et al.[18]	112	Benign and malignant	No significant difference	
	Elit et al.[19]	219	Malignant only	Longer duration of urinary catheterisation	3 fold increase in urinary tract infections with EA
	Ackroyd et al.[29]	4070	Malignant only	No significant difference	
Respiratory complications	Ferguson et al.[14]	135	Benign and malignant	Reduction in pain on coughing	Effect on respiratory complications not studied
	Moslemi et al.[17]	90	Disease not mentioned	Significantly higher sedation in IV analgesia group	Respiratory depression also higher but did not reach significance (p=0.11)
	Ackroyd et al.[29]	4070	Malignant only	No significant difference in incidence of pneumonia	

excellent pain relief, for patients undergoing open gynaecological cancer surgery[14-18]. A minority of studies report conflicting results, however problems with failed epidurals are likely to be responsible for these findings. This highlights the importance of skilled and experienced physicians in the provision of EA[19]. A prospective cohort study by Chen et al. was one of the few studies which found no benefit in pain relief from EA[20]. The reasons behind this paper's conflicting findings compared to the majority of studies remain unclear, but the method of selecting analgesia may offer some insight. Upon analysing patient groups, it appears that PCIA was more commonly used in benign cases, while EA was preferred in malignant cases. This discrepancy in analgesia selection could have influenced the results. An issue which features frequently with EA is failure rate both in technically placing the catheter in the epidural space and failure in the hours and days after the operation. A study in 1999 of 2140 surgical patients demonstrated failure rates of 32% for thoracic and 27% for lumbar epidurals[31]. In addition, a more recent study by Heinink et al. found that 27.2% of successfully placed epidurals failed by 48 hours post op and this number increased to 33.9% at 96 hours[32]. A recent study by Coppens et al. studying EA in chest wall surgery in young adults found more promising results. It found a success rate of 81% and whilst the adverse event rate of over 60% was high, no serious or long term adverse events were reported[33]. However this is a retrospective analysis and is prone to bias.

For several years, it has been suggested that opioids may negatively impact cancer recurrence. The use of opioids is associated with worsening of oncologic outcomes in basic and clinical research. In a study performed in Israel, rats with tumours received laparotomies under general anaesthesia (GA). Those rats who received post-operative opioids, had more metastases three weeks after the operation and an increased incidence of lung tumour retention of up to 17 times as high as those rats who received intrathecal bupivacaine and morphine as analgesia[34]. If robust evidence were to demonstrate that EA enhances cancer-free survival or reduces recurrence rates, this would present a compelling case for its routine use. Surgical procedures are believed to promote micro metastasis by disrupting tumour integrity. Furthermore, evidence suggests that surgical stress and GA, specifically anaesthetic halogenated agents and opioids, may suppress immune function by increasing the production of catecholamines and cytokines, particularly leading to the suppression of Natural Killer (NK) cells[35]. In contrast to systemic opioids, EA mitigates sympathetic activation and thereby attenuates the neuroendocrine stress response.

Recent research largely indicates poorer outcomes in patients receiving opioids compared to those receiving EA. However, the differences in mortality and morbidity appear to be relatively modest, and many of these studies have notable limitations, making the results challenging to interpret and make firm conclusions. The retrospective study by Tseng et al. which favoured EA had a high exclusion rate. Seventy-six patients were excluded because it was not clear from the notes whether or not they received EA[21]. The reason behind this is not explored in the paper. A further issue is that the non-EA arm received less intraperitoneal chemotherapy than the epidural arm. The reasons for this are not discussed, but even after adjusting for these confounding factors, the study still found that EA was independently associated with a reduced risk of recurrence and death. This was observed despite the EA-group having, on average, significantly more advanced cancer stages and higher rates of carcinomatosis.

Importantly in the study by Lin et al. the epidural was used as both anaesthesia and analgesia combined with midazolam sedation. This was in comparison to a GA with sevoflurane, nitric oxide and fentanyl in the non-epidural group[22]. Whilst this has no impact on ascertaining whether an epidural may have a positive outcome in terms of survival, we have no way of knowing whether post operative opioids confer a worse prognosis or whether this is due to the anaesthetic halogenated agents which were used. In addition, epidural anaesthesia for major gynaecological surgery is not common practise currently and therefore would require good evidence of benefit in order to warrant a dramatic change in practise.

In general, there is a paucity of prospective data in this specific group of patients. Early retrospective studies concerning breast, prostate and colorectal cancer showed a reduction in cancer recurrence in patients who received regional anaesthesia[36-38]. However, a recently published prospective randomised multicentre study by Falk et al. studied a similar target population; patients undergoing colorectal cancer surgery[39]. They compared the effect of epidural and IV analgesia on disease free survival and found no difference at five years. Although large and well-conducted, this study examines a different cancer population, making it challenging to determine how relevant its findings are to the gynaecological cancer population. Additionally, the study included not only open surgeries but also minimally invasive and laparoscopic procedures. Given the mechanism

of EA and its impact on sympathetic activation and the stress response, these results could be misleading without a subgroup analysis specific to the type of surgery performed. In addition, a study published in 2019 in the Lancet looking at patients with breast cancer, found no difference in recurrence when comparing regional anaesthesia (paravertebral block) with propofol, when compared to volatile agent and opioids[40].

A further cause for concern for some physicians is the risk of complications with EA. The incidences of epidural abscess, meningitis, nerve injury and epidural haematoma are minimal, however there remains a wide range of reported incidences. This may be due to varying patient populations and indications for epidurals. In addition, when considering the study by Christie et al. which demonstrated a higher than expected incidence of epidural abscess and meningitis, there are a few factors which might explain this[8]. Masks were not documented as being used during the placement of the epidural catheter in all cases and 2 of the three abscesses were recorded in emergency cases. The emergent nature of the cases may have had an impact on the sterility achieved or systemic infection of the patients could also have had an impact. In addition, the epidurals in this study were continued for a median of 5.5 days which is longer than expected. However, even when taking the most pessimistic incidence, the chance of permanent harm due to abscess, nerve damage, or haematoma remains low. Obtaining true informed consent is vital when considering placing an epidural.

Another of the major concerns about the use of EA is the possible increase in incidence of adverse effects. The evidence considering this is conflicting, with the two largest studies in this area producing near opposite results when considering LOS and wound complications. The reason for this is not apparent, however there are some possibilities to explain the conflicting results concerning the increased incidence of VTE in the epidural arm found by Courtney-Brooks et al[16]. In this study, the epidural group did not receive low molecular weight heparin (LMWH) pre-operatively, whereas the PCA group did. It is not clear how long prior to surgery the PCA group received the LMWH, although in most centres this is at least 12 hours prior to surgery, with patients receiving their last dose the evening before. This is the same length of time required in order to perform neuro-axial anaesthesia and so shouldn't have been withheld from the epidural group[35]. Another issue with this study is the timing of LMWH administration. Those patients in the epidural arm, LMWH was held until at least 12 hours post op as per The European Society of Regional Anaesthesia & Pain Therapy (ESRA) and European Society of Anaesthesiology and Intensive Care (ESAIC) joint guidelines41. It is not clear how long after the operation the patients in the PCA arm received LMWH, although often this is administered 6 hours postoperatively. A viable alternative to LMWH would have been unfractionated heparin, which is safe to give 4 to 6 hours after neuro-axial puncture[42, 43]. One last issue is that the length of time to mobilisation was double in the epidural group when compared to the PCA group. Education around mobilisation with an epidural directed at nursing staff would help to reduce this difference. Given these issues and the fact that the majority of other studies found no difference in the rate of VTE in patients receiving EA, it seems likely that other modifiable risk factors associated with the epidural group in this study, but not directly caused by EA, can explain the unusual results.

Given the respiratory depressant effect of opioids and the likely superior pain relief of EA, one might presume that coughing and secretion clearance in patients with epidurals would be better and as a result, the incidence of pneumonia and other respiratory complications would be lower. Unfortunately, the incidence of respiratory complications was not reported in most of these studies and although improved pain on coughing was found in the study by Ferguson et al., the clinical significance of this was not studied[14]. Effects on pulmonary function and pulmonary complications have been more extensively studied in other patient groups such as open abdominal surgery and thoracic surgery. Although shown to improve respiratory mechanics, including a higher postoperative vital capacity (VC), forced expiratory volume at 1 minute (FEV1) and arterial oxygenation, many of the studies have failed to show that this translates into better outcomes for patients[44-47].

These issues surrounding adverse effects and EA have impacted the ERAS and PROSPECT guidelines. Both promote the use of wound infiltration in favour of EA in low-risk patients. Wound infiltration has relatively weak evidence that it improves pain scores post operatively but it is very safe and easy to perform. A study by Gallagher et al. found that wound infiltration following hysterectomy, trended towards a reduction in pain at eight hours, however the result was not significant[48]. In addition, the ERAS guidelines advocate the use of TAP blocks instead of EA[13]. All the recommendations however are for gynaecologic oncology surgery, including minimally invasive surgery where post-operative

pain is less likely to be an issue. In addition to their recommendation about epidurals, they also advise to limit the use of opioids postoperatively.

Conclusion

The optimal approach to post-operative pain management following open gynaecological cancer surgery remains a topic of ongoing debate. EA generally provides superior pain relief compared to systemic opioids when an effective block is achieved. However, one significant challenge is the relatively high incidence of difficulties in inserting the epidural or issues with high epidural failure rates either immediately after or in the days following the operation.

Low grade evidence suggests that EA may offer advantages in progression-free survival (PFS) and overall survival (OS) compared to intravenous opioids, although these differences are likely to be minimal and warrant further prospective evaluation in large cohorts.

Regarding complications, the evidence is even less clear. There appears to be a slight advantage of EA in reducing PONV, ileus, and respiratory complications, while no significant difference is noted in the incidence of VTE. Conversely, EA is associated with a higher incidence of urinary retention, and some studies indicate that it may lead to delayed mobilization and an increased LOS. The lack of homogeneity in the study populations and epidural protocols makes meaningful comparison very difficult.

Previously regarded as the optimal solution for post-operative pain management, EA is now being reassessed, especially with the advent of the latest ERAS guidelines. These guidelines are likely to drive a further shift away from EA. Emerging techniques, such as TAP blocks, erector spinae plane (ESP) blocks, and intrathecal morphine, are gaining popularity. These alternatives have the potential to deliver similar benefits to EA while minimizing associated risks[49,50]. However, initial research into their effectiveness yields conflicting results, likely due to variations in operator skill[51].

Further research is necessary to compare EA with these novel fascial plane blocks and intravenous opioids in the context of open surgery to refine clinical practice. In the meantime, patients at high risk for significant post-operative pain, PONV, ileus, or respiratory complications may still benefit from EA, especially in centres where expertise in alternative locoregional techniques is limited.

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