



Walk in Walk Out Hernia Service - A New Era for Hernia Repair

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Abstract

Background: Herniae cause significant morbidity which results in a reduced quality of life. Approximately 78% of surgical repairs are performed under General Anaesthesia (GA). Repair under Local Anaesthesia (LA) is more cost-effective and life-changing for an increasing number of patients who are refused surgery due to their co-morbidities. This approach is likely to become increasingly necessary as our population ages and co-morbidities rise.

Methods: Retrospective analysis of a prospective database of hernia repairs performed under LA of 696 operations between May 2006 and December 2013 under supervision of a single consultant in the Walk-In-Walk-Out (WIWO) hernia service in one NHS Trust. Data collected included patient demographics, co-morbidities, operation details and complications. Cost-effectiveness analysis performed using hospital payment tariffs.

Results: Of the total 696 repairs, there was zero mortality and five recorded complications. Cost-effectiveness analysis showed that with open hernia repair under LA, our institution saved £411.00 per patient; £561.00 if overnight stay; and £861.00 when compared to overnight stay under GA.

Conclusion: As our aging population develops co-morbidities which are high risk of morbidity/mortality from surgery under GA, open hernia repair under LA is not only cost-effective and safe but is considered the only option. Due to present demands of offering laparoscopic surgery (only possible under GA) in training future surgeons, we feel trainees are inexperienced to manage the needs of the comorbid population unless surgical training is modified to offer operations under LA. Combining priorities of training and cost-effectiveness makes the WIWO hernia service desirable for any healthcare institution.

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Introduction

Hernia repair is the one of the commonest general surgical operations performed world wide [1]. It is estimated that over 120,000 new inguinal herniae [2] are diagnosed in England annually, with inguinal hernia being the most common, having an annual rate of 70,000 - 74,000 surgical operations [3,4]. Inguinal herniae have a prevalence of 1.7% and a lifetime risk in men of 27% and in women of 3% [5]. The other abdominal wall herniae including epigastric, umbilical / para-umbilical, spigelian, ventral, femoral, incisional and parastomal also need surgical repair. Besides being symptomatic, they carry a risk of incarceration and strangulation. The risk of incarceration is approximately 4 per 1000 patients with a groin hernia per year [6]. Risk of strangulation has been reported to <1% per year in patients with inguinal hernias at least in the first few years of onset of the hernia [7]. The mortality associated with elective hernia repair has been reported as 0.07-1.3% under General Anaesthetic (GA) [8,9] but it increases with emergency repair to 3.4-19% [8-14] and 20-fold if bowel resection is required [15]. The reported morbidity is 0.45-22% [10] for elective and 31-58% [10-12] for emergency hernia procedures. Nearly 40,000 patients annually are advised against surgery due to significant co-morbidities [2]. Factors associated with poor outcome following emergency repair include increasing age [6,12,13], increasing co-morbidities/ASA grade [6,8,12,16] femoral hernias [6,11,15,17], bowel resection [6,12,15-17] and prolonged time to diagnosis and surgery [6,14,16].

Surgical repair is the mainstay of treatment for abdominal wall herniae. Patients try TRUSS, tight underclothes and corsets to keep the symptoms under control when repair is not offered because of the level of comorbidity and the risk of surgery. Local Anaesthetic (LA) repair would be ideal for this cohort of patients. The current ASGBI guidelines [18] for inguinal herniae are summarised in (Figure 1). The latest figures [4] demonstrate that approximately 78% of surgical hernia repairs

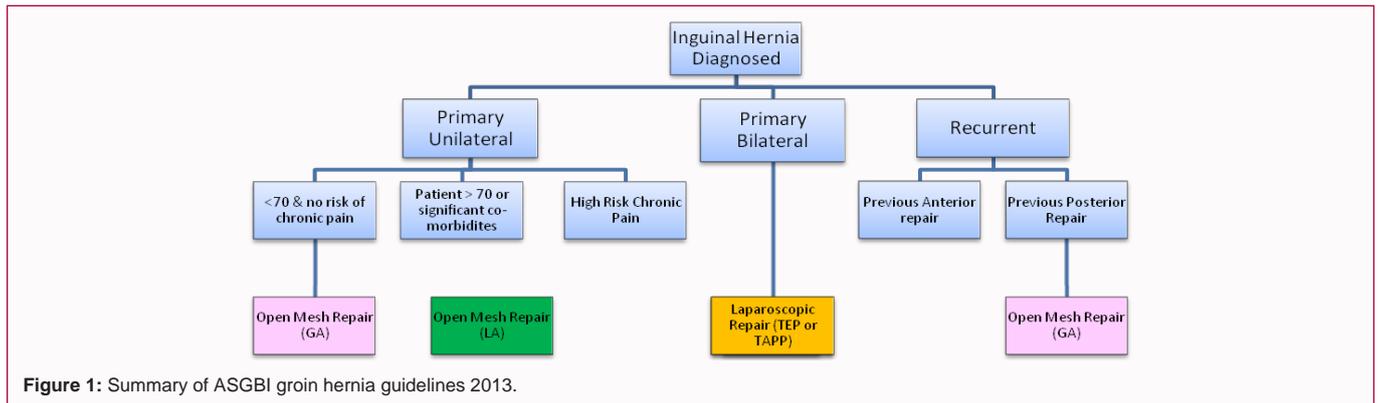


Table 1: Average costs & relative cost ratios. Reproduced with kind permission from Kreckler.

	Cost of Procedure	Relative Ratio	Cost of Procedure Including Stay	Relative Ratio
LA Open	335.62	1	667.54	1
GA Open	587.62	1.75	919.54	1.38
TAP	799.47	2.38	1131.39	1.69
TEPP	843.28	2.51	1175.21	1.76

are open and under GA, 17% laparoscopic and only 5% are open under LA. With the advancement of technology, laparoscopic repair is being utilised more favourably over the traditional open repair. However it can only be done under GA which in elderly patients with comorbidities carries a high risk.

The Walk-In-Walk-Out (WIWO) clinic based at the ACAD unit of North West London Hospitals (NWLH) NHS Trust gives patients the choice of having both their initial consultation and hernia operation under LA on the same day. This is beneficial to the increasing number of elderly patients with significant comorbidities as well as being associated with significant cost savings and reduction in acquired nosocomial infections.

Efficacy & Safety

A significant amount of literature evidence comparing open (LA and GA) and laparoscopic techniques for hernia repair is reported. Whilst laparoscopic intervention offers slightly better outcomes in terms of chronic pain, haematoma formation, wound infection and faster return to normal activities, it is associated with increased seroma formation and an increase in serious complications such as visceral and vascular injuries [2,18,19]. However a significant majority of elderly patients with severe and significant comorbidities are not suitable or are at a significantly higher risk of morbidity/mortality if subjected to GA; besides needing a prolonged hospital stay with the risk of nosocomial infections which can safely be reduced or avoided if the surgery is performed in clinics like WIWO.

A recent large meta-analysis has shown that open hernia repair is associated with a significantly lower recurrence rate (2.49% vs. 4.46%) When compared to laparoscopic repair [19]. In a randomised control trial (RCT), Nordin et al [20] randomised 616 Swedish patients into LA, GA or regional anaesthesia (RA). LA was administered by the surgeons, according to the method described by Amid et al [21], whilst RA and GA were administered by an anaesthetist. They reported that LA was associated with significantly less early-postoperative complications ($P < 0.0001$) as compared to the other groups, no micturition difficulties (0% LA vs. 29% RA vs. 8% GA, $P < 0.0001$), reduced unplanned overnight admission (3% vs. 14% vs.

22% $P < 0.0001$) and shorter hospital stay (3.1 days vs. 6.2 days for RA and GA, $p < 0.0001$). No statistically significant difference was reported amongst the groups with regards to returning to normal activities (9 days), work (14 days) or leisure activities (15 days).

O'Dwyer et al [22] in a similar randomised study of 279 patients in Scotland did not find any significant difference amongst the three groups with respect to complication rate, recovery times or 1 year outcomes. The LA group however did have significantly less pain post-operatively, even though this effect was transient and pain scores between the groups were the same after 24 hours. Interestingly, patient satisfaction was reduced with LA in that only 84% of patients saying they would recommend their procedure compared to 95% of GA patients ($P = 0.011$).

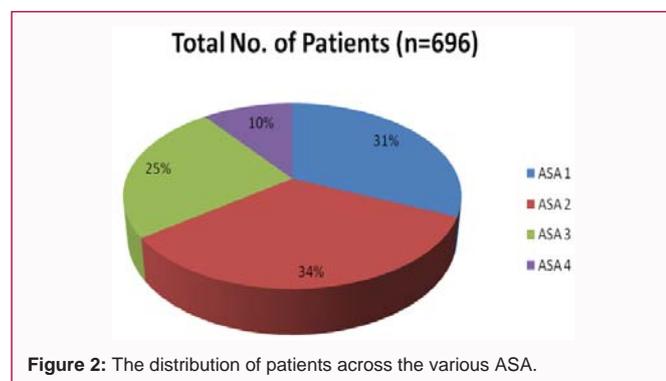
Sanjay & Woodward [23] in a retrospective analysis of 577 hernia operations performed by one surgeon over 9 years reported that LA repair had a significantly higher day case rate as compared to the GA cases ($P < 0.05$), lower urinary retention rate ($P = 0.05$), lower analgesia requirements ($P < 0.05$) and much higher satisfaction scores ($P < 0.05$). This study however lacked randomisation and had large discrepancy between the group sizes.

Financial Aspects

In the current economic climate when many trusts are struggling to balance the books, financial considerations are gaining importance so long as patient care is not affected. McIntosh et al [24] in a cost utility study reported that open surgery was found to be £320 cheaper than laparoscopic surgery. Similar results were also reported by McCormack et al [2] showing a cost difference of £300-350 between open and laparoscopic procedures. Although these studies did not compare LA and GA costs between the groups, they do unequivocally highlight that as a class procedure, open repair is significantly cheaper than laparoscopic repair. LA repair by virtue of requiring less medication and monitoring or no pre-assessment, as in the Walk-In-Walk-Out Clinic by Bhutiani [25] would always be cheaper than a GA repair (open or laparoscopic). Indeed Khan et al [25] reported that LA costs on average £441 less than a GA day case per patient when they were operated on according to WIWO clinic protocol for

Table 2: Co-morbidities in all patients recorded in WIWO database.

Co-morbidity		Percentage of Total No. of Patients (n=696)
Cardiac	Ischaemic Heart Disease, Myocardial Infarction, Angina, Pacemaker, Heart Failure	22.99%
	Hypertension	46.26%
	Arrhythmia (eg AF)	7.61%
	Valvular Heart Disease	3.59%
Respiratory		18.53%
Diabetes		12.21%
Renal Disease (including dialysis)		5.60%
Neurological	TIA/CVA/Blackouts	7.18%
	Other	3.74%
Peripheral Vascular Disease		2.01%
DVT/PE		0.86%
Malignancy		7.18%
Obesity		4.31%

**Figure 2:** The distribution of patients across the various ASA.

an open inguinal herniorrhaphy and £861 as an inpatient. He recorded the savings for his 122 patients to be £50, 142 and £105, 042 over the year for both the WIWO clinic and as an inpatient stay respectively. This is a substantial saving that no hospital manager should argue with. Kreckler et al [26] provided an in-depth direct cost comparison between the various methods of inguinal hernia repair within the UK, of which their results are summarised in Table 1.

Open LA repair is by far the most cost effective method of inguinal hernia repair besides providing the same quality of care for the patients. Kreckler et al [26] state evidence shows that LA repair is not inferior to other modes of repair and advise that there should be significant scope to increase the proportion of procedures taking place under LA. The most important aspect of this analysis is that a significant number of elderly patients with comorbidities needing hernia repair are not only at a high risk with GA but also need extensive investigations before surgery is offered. This significantly adds to the cost, waiting time and risk of incarceration/strangulation which can all be avoided by doing their procedure under LA.

As demonstrated, LA does carry many benefits and can be offered to a patient demographic who once may not be deemed appropriate to have surgery due to high anaesthetic risks. Another benefit of the above WIWO service includes relieving the pressure off waiting lists and hospital services, thus resulting in a higher turn-over of operations performed and better patient-centred care. This also allows General Practitioners (GPs) to have more input and control of who they refer for hernia repairs and the associated funding behind it.

Once given the eligibility criterion, the GPs are able to book directly onto the WIWO service and give a date of operation to the patient from their consulting room.

With such benefits of performing procedures under LA, it is imperative that the basic surgical skills acquired when performing these operations are continued to be practiced and taught in the surgical curriculum. The technique of conversion to the open approach should always be learnt as a bail out option if the laparoscopic approach is no longer considered a safe option, however, these techniques should not be learned as a back-up plan but instead should be utilised with the best operative conditions to ensure a successful outcome. Thus surgical trainees should be taught and required to learn open surgical techniques and reach proficiency in these prior to advancing to laparoscopic surgery, so as to be able to serve the aging population of the future.

Aim

We present a group of patients undergoing elective hernia repair under LA who in many departments including ours would have and have been refused surgery because of their comorbidities and their resultant ASA grades. We report the cost-effectiveness of performing the elective hernia repairs under LA as compared to the same procedure done under GA. We also recommend that in a specific cohort of patients, it is necessary to repair herniae under LA, due to the high risk of GA. Such open surgical skills must not be allowed to fade away due to the pressure of laparoscopic surgery by patients, trainees and surgeons alike.

Methods

Patients undergoing hernia repair under local anaesthetic in the WIWO hernia clinic, under the care of a single consultant surgeon (RB) were recorded prospectively since 2006. Data including demographic details, medical co-morbidities and operation comments were recorded. These were respectively analysed and review of the notes was undertaken to establish complications. All patients were placed on the WIWO hernia list by the GPs in the covering area and assessed by a single surgeon before being offered a repair under LA during the consent process if deemed appropriate. The American Society of Anaesthesiologists (ASA) grade was used to classify co-morbidities and the group was divided into groups with ASA grade 1 and 2 and

grades 3 and 4. Patients are administered 0.5mg - 1.5g of Midazolam IV at the time of operation pre-operatively. Each patient received a single dose of 1.5g Cefuroxime unless allergic to Penicillin, in which case the Trust's antibiotic guidelines would stipulate an appropriate alternative. The surgeon then administers a 60ml mixture of 0.25% lignocaine with adrenaline (1:200,000) (maximum permitted is 7 mg/kg body weight) and 0.25% bupivacaine with adrenaline (maximum permitted is 4 mg/kg body weight) to induce a nerve and infiltration block [27]. All procedures were performed with the same technique and the use of a mesh (tension-free Lichtenstein technique for inguinal hernias). Operations were performed both by consultant and trainee with the consultant scrubbed as the assistant. The total cost of performing each hernia repair under LA is then compared to the total cost of the repair under GA and then also including costs of an inpatient stay. This included the costs of medication, pre-operative outpatient consultations, investigations, pre-assessment clinics, anaesthetic reviews, consumables, post-operative stay and follow consultations. The cost of pre-assessment was deduced based on the investigations performed, the resources used and also the time of the nursing staff and junior doctor.

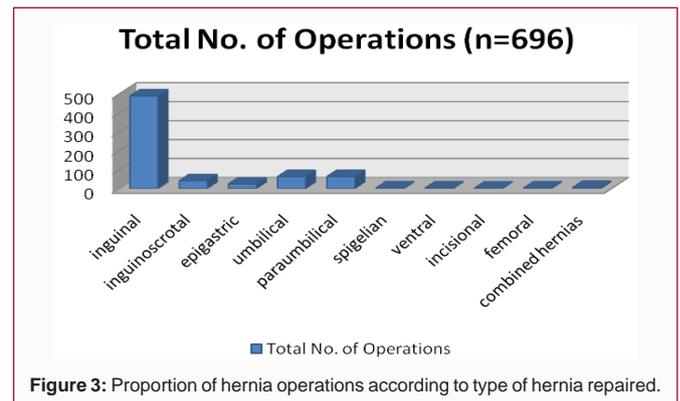
Results

696 operations were recorded between May 2006 and December 2013. 102 (14.7%) patients were female and 488 (85.3%) were male. Of the total, 527 were inguinal, 63 umbilical, 63 paraumbilical, 24 epigastric, 3 femoral, 3spigelian, 4inguino-scrotal, 3 ventral, 2 incisional and 6 combined repairs (where 2 hernias were repaired at the same time). 22 operations were for recurrence. 4 contained bowel & omentum and 2 required omental resection. 31.5% of patients were ASA- 1, 33.5% ASA- 2, 24.7% ASA- 3 and 10.3% ASA- 4. The age range varied from 23 years to 95 years, with a mean age of 61.0 years. Of those patients who were ASA 3 or 4, the mean age was 71.9 years. The patients' co-morbidities are summarised in Table 2. The distribution of patients across the various ASA grades is shown in (Figure 2). Five patients had documented refusal of general anaesthetic due to high risk when assessed by anaesthetists. 145 patients (20.8%) were taking anti-coagulation (warfarin/aspirin/clopidogrel).

Over the study period there was no mortality. There were only five recorded complications - 6 (0.9%) patients developed haematomas (five of which were taking anti-coagulation), 2 (0.3%) post-op retention and were discharged home with a catheter, 2 (0.3%) developed seromas (one of which needed aspiration), 3 (0.4%) developed chronic pain which all resolved by six months, and 1 (0.1%) developed a stitch granuloma.

Discussion

The WIWO database analysed data collected over a nine year period but it still continues to accumulate to this day. The WIWO hernia service was the first of its kind to be implemented in the NHS and continues to provide successful surgical care to hundreds of patients in the North West London area each year and helps to tackle the waiting time of 18 weeks (as per the Government's recommended target time) for a hernia repair. According to Leff et al [2] in 2006, a hernia repair in a private clinic would cost approx. £1300. This has increased substantially to £2250. Likewise, to perform an open hernia repair under a GA on the NHS today would cost £1440 and as an inpatient under GA is £1890. This is a large price for taxpayers to pay compared to the significantly lesser amount of £1029 (in the NWLH NHS Trust) of having the same hernia repair under LA as per the



WIWO hernia service which means they can go home the same day. If the patient did need an overnight stay (mainly for social reasons) then this would cost an added £300. This means that by performing open hernia repairs under LA allows the patient to avoid the high risk of GA, extensive investigations and nosocomial infections. In addition, our Trust could potentially save £411.00 per patient when compared to a day case hernia repair under GA; £861.00 compared to an overnight stay under GA; and £561.00 if our LA repair needed an overnight inpatient stay post-operatively for any reason.

So for the 696 operations performed in our WIWO hernia clinic, over the 9 year period, the NHS would have only paid £716,184.00 (not taking into account for inflation) compared to an approx. sum of £1,002,240.00 if those very same cases were performed under a GA. This equates to a saving of £286,056.00 that can be better allocated to other services. Studies designed to analyse the cost-effectiveness have reported significant savings by performing hernia repairs under LA when compared with open under GA [29] or laparoscopic procedures [30]. From the data shown, we have found that 85% of patients undergoing hernia repair were male and of these 70.7% had an inguinal hernia repaired which is by far the most common type of hernia repair in the UK. Unfortunately, the database did not record whether the herniae were direct or indirect in nature. However the repair procedure is the same for both and this should not make any difference to the reported and recorded benefits of this approach and such clinics.

Besides the financial benefit, the most important outcome to note is that patients with ASA 3 & 4 (59% of our cohort) are able to undergo the operation as a day case (without being exposed to the risk of GA and nosocomial infections) and live a better quality of life independently. A significant proportion of these patients would have either been refused surgery due to their significant comorbidities and resultant high anaesthetic risk, or forced to live with the discomfort/pain of the hernia. These patients would have also undergone a number of expensive tests and specialist opinion before the final decision to operate or not to operate would be taken. In contrast a significant majority could be offered the hernia repair under LA without the need for expensive tests or specialist opinion with the added waiting time making patients continued suffering.

Sanjay et al [23] looked at ASA grades 3 and 4 as being suitable for day case hernia repair and found that 23% of their patients were ASA 3 and 5% ASA 4. They concluded that patients with ASA grades 3 and 4 can undergo day case inguinal hernia repair with similar complication rates to patients with ASA grades 1 and 2, when surgery is performed under local anaesthetic. As a result, it is understandable that patient

satisfaction would also increase as many patients would appreciate the opportunity to alleviate their hernia symptoms. Gunnarsson et al [28] in 1999 reported the outcome of patient satisfaction with elderly patients and concluded that elective hernia repair in the elderly population is highly appreciated by the patients and is worthwhile. With an aging population who have increasing number and severity of co-morbidities and advancing medical treatments, hernia repair under LA can be offered routinely and we feel that age and co-morbidities are not a reason to refuse patients surgery. Hernia repair under LA as a WIWO procedure offers cost reductions and provides a quality of life without the risks associated with GA.

Conclusion

Despite being economically favourable and equivalent to other surgical techniques in terms of recurrence and post-operative pain, open repair under LA is still a vastly under-used method of treating inguinal and abdominal wall herniae. With the ever increasing age of the population, there will inevitably be many more patients who cannot safely have general anaesthetic due to their co-morbidities and thus require an intervention which excludes such a risk. The current pressure for training surgeons to become proficient in laparoscopic techniques risks the loss of the skill and competency in undertaking this kind of repair and thus in future many of these patients may not be able to have definitive repair, thus exposing them to the risks that lie therein. With increasing emphasis of teaching/learning laparoscopic skills due to advances of the last decade or so, the art of basic surgical skills is becoming clouded by the era of so-called 'keyhole surgery', the Minimally invasive surgery, and robotic surgery due to increasing patient demand and surgeon's preference because of the added excitement of the surgical skills. Unfortunately, with the aging population and the increasing number and severity of co-morbidities, a significantly high proportion of these patients are likely to be refused surgery due to the risks associated with the GA needed to undertake these new advances in keyhole surgery. We have shown that LA hernia repair is superior to GA in terms of cost-effectiveness, patient complications and satisfaction and thus by extension preferable to laparoscopic repair in certain situations i.e. in those patients who are unable to tolerate a GA due to age and significant co-morbidities.

To be well equipped to serve the ageing population of tomorrow, we propose that training surgeons of today and future should be expected to do a mandatory number of hernia repairs under local anaesthesia, in addition to being exposed to laparoscopic skills. We also consider initiatives such as WIWO hernia services to show many benefits for both healthcare organisations and the patients and should be implemented in other hospital Trusts to allow for a more cost-effective NHS.

References

1. <http://www.hernia.org/>
2. Leff D, Bhutiani R. Give the patients the choice- the Walk in Walk out (WIWO) hernia clinic. *J Ambulatory Surgery*. 2006;12(3):125-9.
3. NICE NifCE-. Laparoscopic Surgery for Inguinal Hernia Repair. Technology Appraisal. 2004;83.
4. NICE NifCE. NICE implementation uptake report: Laparoscopic surgery for inguinal hernia repair; 2010.
5. Jenkins JT, O'Dwyer PJ. Inguinal hernias. *BMJ*. 2008;336(7638):269-72.
6. Van Den Heuvel B, Dwars BJ, Klassen DR, Bonier HJ. Is surgical repair of an asymptomatic groin hernia appropriate? A review. *Hernia*. 2011;15(3):251-9.
7. Leubner KD, Ewigman B, Loven B, William M. Chop. What is the risk of bowel strangulation in an adult with an untreated inguinal hernia? *Journal of Family Practice*. 2007;56(12):1039-41.
8. Nehme AE. Groin hernias in elderly patients. Management and prognosis. *Am J Surg*. 1983;146(2):257-60.
9. Nilsson E, Kald A, Anderberg B, Bragmark M, Fordell R, Haapaniemi S, et al. Hernia surgery in a defined population: a prospective three year audit. *Eur J Surg*. 1997;163(11):823-9.
10. Lewis DC, Moran CG, Vellacott KD. Inguinal hernia repair in the elderly. *J R Coll Surg Edinb*. 1989;34(2):101-3.
11. Malek S, Torella F, Edwards PR. Emergency repair of groin herniae: outcome and implications for elective surgery waiting times. *Int J Clin Pract*. 2004;58(2):207-9.
12. Martínez-Serrano MA, Pereira JA, Sancho JJ, López-Cano M, Bombuy E, Hidalgo J. Study Group of Abdominal Hernia Surgery of the Catalan Society of Surgery. Risk of death after emergency repair of abdominal wall hernias. Still waiting for improvement. *Langenbecks Arch Surg*. 2010;395(5):551-6.
13. Malik AM, Khan A, Talpur KA, Laghari AA. Factors influencing morbidity and mortality in elderly population undergoing inguinal hernia surgery. *J Pak Med Assoc*. 2010;60(1):45-7.
14. Kjaergaard J, Bay-Nielsen M, Kehlet H. Mortality following emergency groin hernia surgery in Denmark. *Hernia*. 2010;14(4):351-5.
15. Nilsson H, Stylianidis G, Haapamäki M, Nilsson E, Nordin P. Mortality after groin hernia surgery. *Ann Surg*. 2007;245(4):656-60.
16. Davies M, Davies C, Morris-Stiff G, Shute K. Emergency presentation of abdominal hernias: outcome and reasons for delay in treatment - a prospective study. *Ann R Coll Surg Engl*. 2007;89(1):47-50.
17. Dahlstrand U, Wollert S, Nordin P, Sandblom G, Gunnarsson U. Emergency femoral hernia repair: a study based on a national register. *Ann Surg*. 2009;249(4):672-6.
18. ASGBI. Groin Hernia Guidelines; 2013.
19. Treadwell J, Tipton K, Oyesanmi O, Sun F, Schoelles K. Surgical Options for Inguinal Hernia: Comparative Effectiveness Review. Comparative Effectiveness Review 2012.
20. Nordin P, Zetterström H, Gunnarsson U, Nilsson E. Local, regional, or general anaesthesia in groin hernia repair: multicentre randomised trial. *Lancet*. 2003;362(9387):853-8.
21. Amid PK, Shulman AG, I L Lichtenstein. Local anesthesia for inguinal hernia repair step-by-step procedure. *Ann Surg*. 1994;220(6):735-7.
22. O'Dwyer PJ, Serpell MG, Millar K, Paterson C, Young D, Hair A, et al. Local or General Anesthesia for Open Hernia Repair: A Randomized Trial. *Ann Surg*. 2003;237(4):574-9.
23. Sanjay P, Woodward A. Inguinal Hernia Repair: Local or General Anaesthesia? *Annals of The Royal College of Surgeons of England*. 2007;89(5):497-503.
24. Medical Research Council Laparoscopic Groin Hernia Trial Group. Cost-utility analysis of open versus laparoscopic groin hernia repair: results from a multicentre randomized clinical trial. *Br J Surg*. 2001;88(5):653-61.
25. Khan RA, Bhutiani RP. The Walk In Walk Out Hernia Clinic: A study of its cost effectiveness. *Ambulatory Surgery*. 2008;14(14).
26. Kreckler S, McWhinnie D, Khaira H, Jackson I. The financial considerations of inguinal hernia surgery: does the surgical approach matter? *Ambulatory Surgery*. 2012;18:10-3.
27. Leff DR, Nortley M, Dang V, Bhutiani RP. The effect of local cooling on

- pain perception during infiltration of local anaesthetic agents, a prospective randomised controlled trial. *Anaesthesia*. 2007;62(7):677-82.
28. IbañezRde M, A Saied SA, Vallejo JA, Canales JM, Prieto CB, Sotos FE. Cost-effectiveness of primary abdominal wall hernia repair in a 364-bed provincial hospital of Spain. *Hernia*. 2011;15(4):377-85.
29. Eklund A, Carlsson P, Rosenblad A, Montgomery A, Bergkvist L, Rudberg C; Swedish Multicentre Trial of Inguinal Hernia Repair by Laparoscopy (SMIL) study group. Long-term cost-minimization analysis comparing laparoscopic with open (Lichtenstein) inguinal hernia repair. *Br J Surg*. 2010;97(5):765-71.
30. Gunnarsson U, Degerman M, Davidsson A, Heuman R. Is elective hernia repair worthwhile in old patients? *Eur J Surg*. 1999;165(4):326-32.