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Hoofdredactie: **Dr. P.A. van Beest & Dr. ir. J.-W.H. Korstanje**

De vijf beste abstracts

Ingediend voor de Anesthesiologendagen

Accelerated surgery versus standard care in hip fracture (HIP ATTACK): an international, randomised, controlled trial

Flavia K. Borges, Hip Attack Investigators

69 hospitals in 17 countries [Canada, Spain, India, Pakistan, South Africa, Italy, Poland, the UK, the USA, Malaysia, Belgium, France, Thailand, the Netherlands [Deventer Hospital], China, Hong Kong, and Colombia]

Introduction
Observational studies have suggested that accelerated surgery is associated with improved outcomes in patients with a hip fracture. The HIP ATTACK trial assessed whether accelerated surgery could reduce mortality and major complications.

Methods
HIP ATTACK was an international, randomised, controlled trial done at 69 hospitals in 17 countries. Patients with a hip fracture that required surgery and were aged 45 years or older were eligible. Research personnel randomly assigned patients (1:1) through a central computerised randomisation system using randomly varying block sizes to either accelerated surgery (goal of surgery within 6 h of diagnosis) or standard care. The coprimary outcomes were mortality and a composite of major complications (mortality and non-fatal myocardial infarction, stroke, venous thromboembolism, sepsis, pneumonia, life-threatening bleeding, and major bleeding) at 90 days after randomisation. Patients, health-care providers, and study staff were aware of treatment assignment, but outcome adjudicators were masked to treatment allocation. Patients were analysed according to the intention-to-treat principle. This study is registered at ClinicalTrials.gov (NCT02027896).

Results
Between March 14, 2014, and May 24, 2019, 27 701 patients were screened, of whom 7780 were eligible. 2970 of these were enrolled and randomly assigned to receive accelerated surgery (n=1487) or standard care (n=1483). The median time from hip fracture diagnosis to surgery was 6 h (IQR 4–9) in the accelerated-surgery group and 24 h (10–42) in the standard-care group (p<0.0001). 140 (9%) patients assigned to accelerated surgery and 154 (10%) assigned to standard care died, with a hazard ratio (HR) of 0.91 (95% CI 0.72 to 1.14) and absolute risk reduction (ARR) of 1% (–1 to 3; p=0.40). Major complications occurred in 321 (22%) patients assigned to accelerated surgery and 331 (22%) assigned to standard care, with an HR of 0.97 (0.83 to 1.13) and an ARR of 1% (–2 to 4; p=0.71).

Conclusion
Among patients with a hip fracture, accelerated surgery did not significantly lower the risk of mortality or a composite of major complications compared with standard care.

Respiratory complications during procedural sedation in adult patients

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Introduction
Procedural sedation is a growing and important medical practice within the domain of anesthesiology. The administration of sedatives and strong opiates during procedural sedation are scarce. Therefore, we studied the incidence and severity of respiratory complications during procedural sedations in our hospital.

Methods
Data from procedural sedations performed according to national guidelines for sedation outside the operation room in our hospital between January 2011 and December 2018 (3459 males and 2534 females) were extracted from our Anesthesia Information Management System to create a retrospective cohort study. Additional information was collected from the electronic patient record. We investigated the incidence of desaturation defined as peripheral oxygen saturation <90% lasting at least two consecutive minutes. The severity of desaturations was calculated as the depth of desaturation times the duration of the event. The relationship between severity of desaturations and Body Mass Index (BMI), American Society of Anesthesiologists (ASA) classification and duration of procedures was investigated.

Results
29% of moderately to deeply sedated patients developed a respiratory desaturation. A high incidence of desaturations was found (54.2% and 55.9%) in patients undergoing heart catheterization and undergoing bronchoscopy respectively. Most desaturations occurred in the procedures lasting > 120 minutes, especially in latter phases of the procedures. The severity of desaturations increased in the cardiology procedures > 120 minutes. There was no correlation between BMI or ASA and the incidence of desaturations.

Conclusion
The present study demonstrates that a considerable group of patients is at risk for respiratory complications, during procedural sedation performed according to international guidelines with a positive correlation demonstrated with increasing duration of medical procedures. Although severe respiratory complications are rare, additional research is needed to investigate the clinical consequences of these cumulative desaturations.

The effect of intracervical terlipressin on carboxyhaemoglobin formation during hysteroscopic surgery: a double-blind, placebo-controlled trial

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Introduction
Transcervical resection of the endometrium or myoma is a safe minimally invasive procedure. However, intravasation of distension fluid and venous gas emboli during the procedure may result in severe haemodynamic complications. A previous study showed a potentially dangerous rise in carboxyhaemoglobin (HbCO) caused by diathermia used during hysteroscopic surgery. The rise in HbCO correlated well with the amount of intravasation. Intracervical installation of terlipressin, an analogue of vasopressin, is known to reduce intravasation. Therefore we sought to investigate whether its use attenuates the rise in HbCO during hysteroscopic surgery.

Methods
In this double-blind study forty-eight patients scheduled for transcervical myoma or endometrium resection were randomised to receive either intracervical terlipressin or placebo before surgery. HbCO levels were determined pre- and postprocedural. Intravasation was calculated by substracting the amount of inflow and outflow of the irrigation fluid.

Results
In the terlipressine and the placebo group HbCO levels increased significantly: 4.7%(P=0.009) versus 3.4%(P=0.0001) respectively. However there was no significant difference found between both groups(P=0.698). The amount of intravasation correlated significantly with HbCO levels (P=0.009). The amount of intravasation did not differ significantly between both groups(P=0.753).

Conclusion
Intracervical terlipressine did not significantly attenuate the rise in HbCO or effect the amount of intravasation during hysteroscopic surgery. The generally accepted policy to continue surgery up till the moment that the maximum accepted intravasation threshold is reached, might have confounded these results.

Reduction of unplanned ICU admissions with introduction of continuous vital sign monitoring

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Introduction

Periodic vital sign monitoring with early warning scores (EWS) is widely adopted for early detection of clinical deterioration, such as postoperative complications. Previous studies yielded conflicting results regarding effects on patient outcomes due to the low predictive value of discontinuous vital sign data. Continuous monitoring (CM) has been promoted to improve prediction of deterioration. In 2018 we introduced CM with automated registration in the EHR at a gastrointestinal surgical and general internal medicine ward. We studied the effect of CM on denominators of deterioration. Comparison was done with periodic monitoring before CM introduction.

Methods

We performed a before (1 year before CM;PRE) and after (1 year during CM;POST) study in all patients admitted at these wards. Differences in unplanned ICU-admissions (uICU), RRT-calls and deaths, ward and hospital stay were assessed. For control on selection bias and to exclude trends in hospital admissions, we analyzed uICU-admissions and RRT-calls for 15 other wards with periodic measurements (PRE and POST) and for the same wards the year before the PRE period (2016).

Results

In total 2,023 (PRE) and 1,873 patients (POST) were admitted. POST uICU-admissions were 34 percent less compared to PRE uICU-admissions (44 vs 29 per 1000 admission weeks, p=.013). RRT calls decreased from 65 to 46 (p=.011). Decreases were comparable for both wards. uICU-admissions did not decrease at the 15 other wards nor did similar decreases occur in the earlier years. Mortality was comparable for both periods, ward (4.2 vs 4.2 days) and hospital stay (5.2 and 5.2 days) did not differ.

Conclusion

CM led to significant reduction in uICU-admissions and fewer RRT-calls. This may indicate improved vigilance by clinicians at the ward. Next steps are CM-driven predictive analytics predicting clinical deterioration and an accompanying new early warning protocol.

Early postoperative pain after laparoscopic donor nephrectomy predicts 30-day postoperative infectious complications: a pooled analysis of randomized controlled trials

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Introduction

Our research group recently published a positive association between early postoperative pain and 30-day postoperative complications in a broad surgical population. To investigate whether heterogeneity of the population and surgical procedures influenced these results, we explored this association in a homogenous surgical population.

Methods

We performed a secondary analysis of the LEOPARD-2 and RELAX-1 study in laparoscopic donor nephrectomy patients (n=160). Pain scores on the post-anesthesia care unit (PACU) and postoperative day (POD) 1 and 2 were compared between patients with infectious, non-infectious, and no complications 30 days after surgery, by ANOVA with post-hoc test and Bonferroni correction. For unacceptable pain, Fisher's exact test was used.

Results

In 160 living kidney donors, 18 infectious complications and 10 non-infectious complications developed within 30 days after surgery (Table 1). Patients who developed infectious complications had significantly higher maximal pain scores on POD1 and 2 (6.7 ± 2.1 and 6.4 ± 2.8) than patients without complications (4.9 ± 2.2 and 4.1 ± 1.9, p=0.006 and P=0.000, respectively). The percentage of patients with an unacceptable pain score (NRS ≥6) was significantly higher in the infectious complications group (figure 1B, P=0.018 on POD1 and P=0.000 on POD2). Logistic regression analysis identified unacceptable pain (NRS ≥6) on POD2 as the strongest predictor for 30-day infectious complications (OR 6.09, P=0.001).

Conclusion

Results confirm the association between early postoperative pain and 30-day infectious complications in a separate, homogenous surgical population. Further clinical trials should focus on finetuning of postoperative analgesia to elucidate the effects on the endocrine and immune response, preserve immune homeostasis and prevent postoperative infectious complications.

Figure 1

A) Maximal postoperative pain scores (NRS 0-10) at the post-anaesthesia care unit (PACU), postoperative day (POD) 1 and 2 for patients who developed no complications, non-infectious complications and infectious complications.
B) The percentage of patients who reported an unacceptable pain score (NRS ≥6) in each group.

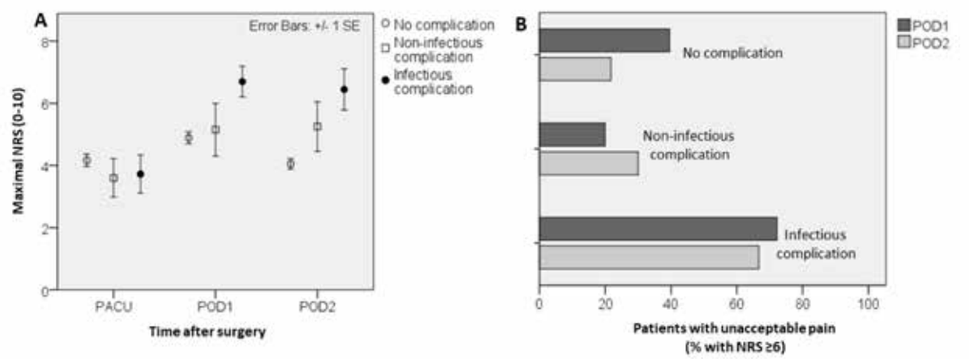

Table 1.
Postoperative complications

			Complication	Days after surgery
Infectious complications [A]	N = 18	9	Urinary tract infection	3, 3, 3, 3, 4, 6, 7, 14, 20
		4	Wound infection	8, 9, 10, 25
		2	Epididymitis	13, 14
		2	Fever e.c.i. (treated with antibiotics)	1, 1
		1	Pneumonia	3
Other complications [A]	N = 10	3	Dyspnoea / respiratory insufficiency	0, 2, 3
		2	Ileus	2, 5
		2	Severe hypertension	2, 2
		1	Surgical site hematoma	1
		1	Persistent hiccups requiring CT scan	6
		1	Meatus stenosis	14
No complications	N = 131			

[A] Deviation from the ideal course requiring additional treatment or intervention.
E.c.i = e causa ignota, fever of unknown origin.

Abstracts ingediend ten behoeve van de Anesthesiologendagen

Systemic neutrophil activation products as biomarkers in patients with acute abdominal pain, a hypothesis generating study

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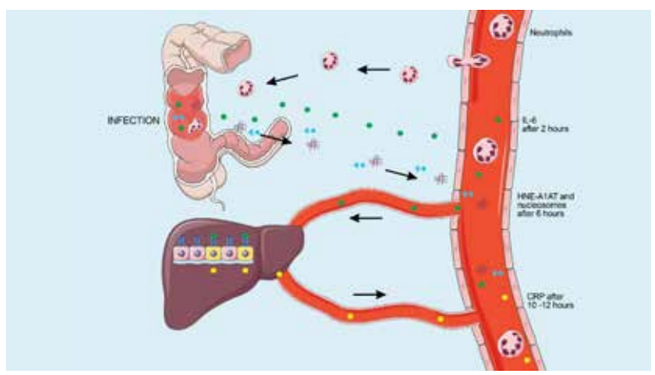
Introduction
Acute abdominal infection remains a diagnostic challenge, particularly when differentiating between mild and severe causes. Currently used biomarkers such as C-reactive protein (CRP) are usually elevated during infection but do not contribute to a reliable diagnosis. The aim of this study was to assess the potential of neutrophil activation products as early biomarkers in patients with an acute abdominal infection.

Methods
Patient data and samples from a prospective study in patients with acute abdominal pain at the emergency department were used. Neutrophil activation products, HNE-A1ATc and nucleosomes levels, were compared to those of healthy volunteers. In addition, the diagnostic accuracy for mild and severe abdominal infections was compared to currently used biomarkers such as CRP and white blood cell count (WBC).

Results
A total of 90 patients with an acute abdominal infection were included and compared to 19 healthy volunteers. Patients with abdominal infection had significantly higher concentrations of HNE-A1ATc ($p<0.001$) and nucleosome levels ($p=0.001$) (median [IQR]: 67 [47-107] ng/ml and 23 [14-38] u/ml, respectively) when compared to healthy volunteers (25 [19-35] ng/ml and 15 [7-20] u/ml, respectively). More importantly, both biomarkers were able to differentiate between mild and severe abdominal infections, HNE-A1ATc (median [IQR]) 54 [43-87] versus 100 [52-200] ($p=0.002$) and nucleosome levels 21 [13-31] versus 37 [22-61] ($p<0.001$), respectively. These markers had a slightly higher accuracy when compared to CRP and WBC.

Conclusion
Neutrophil activation products are elevated in patients with an acute abdominal infection and are able to differentiate between mild and severe infections. Results are promising; nonetheless, future studies are needed to determine the true potential of these markers.

Figuur 1



EsKETamine intravenous treatment for refractory CHronic Pain. (KETCHuP)

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Introduction
Although intravenous esketamine is widely used for treatment of refractory chronic pain, it is still unknown whether it works for all types of chronic pain. Furthermore, data regarding the possible side-effects of this treatment is not well documented. This study summarizes the therapeutic value and side effects of intravenous esketamine treatment of refractory chronic pain.

Methods
This 3 year retrospective observational study (2016-2019) describes the global received effect and side effects of intravenous esketamine administrations. The initial dose of administered esketamine was approximately 0.1 mg/kg/hour. A wide range of characters of pain were included. Patients received an 8 hour administration of iv esketamine. In the case of global received effect for 6 weeks or more, the treatment was repeated with a minimum interval of 3 months. When the effect was shorter than 6 weeks, the duration of the infusion was changed to a multiday treatment (24 hours, 48 hours or 96 hours). If the global received effect was shorter than one week, the treatment was stopped. When available, registered Visual Analogue Scale(VAS) reduction was registered to quantify pain relieving effects.

Results
A total number of 254 patients received 441 administrations of intravenous esketamine with a 8 hour duration. Causes of pain varied among patients, with mostly visceral pain (14.2%), neuropathic pain (18.5%), nociceptive pain (13%), ACNES (10.2%), complex regional pain syndrome (16.9%) and failed back surgery syndrome (8.7%). 8 hour esketamine administration was found to be effective in 128 patients (50.4%). A binary logistic regression analyse was done and did not found any confounders. 77 patients received a multiday treatment, this was effective in 44 patients (57%). Mean VAS reduction was 3.2 points, with a median effect of 5 weeks. In 45% of the administration mostly harmless side effects were reported during administration.

Conclusion
Esketamine may have an positieve effect in a wide range of characters of refractory chronic pain. Pain was reduced in half of the study population. There is a median pain reducing effect for 5 weeks and it may further reduce VAS. A larger prospective study, with an optimized treatment protocol, possibly randomized with a placebo control group, is needed to confirm the effectiveness of esketamine in refractory chronic pain.

Veno-arterial Extracorporeal Life Support in postcardiotomy cardiogenic shock; predictors of outcome in a retrospective single centre study

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Sint Antonius Ziekenhuis te Nieuwegein

Introduction
Acute heart failure after cardiac surgery is associated with high early mortality. In these patients veno-arterial extracorporeal life support (VA-ECLS) can be used as a rescue strategy. The use of VA-ECLS increased substantially with limited evidence of its benefits on early and late treatment outcome. Few cohort studies have described predictors of mortality and outcome in patients with postcardiotomy cardiogenic shock (PCCS) treated with ECLS, such as a poor left ventricular ejection, pre-operative renal insufficiency and elevated plasma lactate. The aim of this study is to identify predictors associated with mortality of refractory PCCS patients receiving ECLS.

Methods
Between January 2013 and December 2017 66 patients received VA-ECLS for refractory PCCS in the St. Antonius Hospital. The outcome variable in this study was ECLS-mortality. Demographic, clinical and laboratory data of ECLS patients were collected retrospectively as potential predictors of ECLS-mortality. Following univariate analysis, relevant parameters were entered in a binary multivariate logistic regression analysis to investigate associations with ECLS-mortality.

Results
Thirty-six of the 66 (55%) patients died during ECLS following CABG surgery (n=11), valve surgery (n=17), aortic surgery (n=5) or combined procedures (n=33). The median age was 67 years [59 – 73], 44 (67%) patients were men. Median duration of the ECLS was 5 days [3-9]. ECLS-mortality was positively associated with age (p=0.027), Body Mass Index (BMI) (p=0.025) and pre-ECLS PaO2 (p=0.016). The association with pre-ECLS lactate levels did not reach significance (p=0.077). There were no associations found between ECLS-mortality and left ventricular ejection fraction or kidney function (eGFR).

Conclusion
Age, BMI and pre-ECLS PaO2 were positively associated with ECLS-mortality in patients with PCCS. Further prospective studies are needed to investigate reliable predictors for post-cardiotomy ECLS outcome.

Predicting the effect of Transcutaneous Electrical Nerve Stimulation in chronic pain patients: a prospective study

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St. Antonius Ziekenhuis

Introduction
Introduction: Transcutaneous Electrical Nerve Stimulation (TENS) is frequently used to treat chronic pain. Factors associated with outcomes of TENS therapy are relatively unknown.

Methods
Methods: A prospective observational study was conducted to study the association of predefined patient- and disease related factors to patient reported outcomes of TENS therapy in chronic pain patients. Following informed consent, baseline variables including age, gender, pain location, Body Mass Index (BMI), patient expectations (NRS), Hospital Anxiety and Depression Scale (HADS), Central Sensitization Inventory (CSI), Short Form (36) Health Survey and Pain intensity (NRS) were recorded. Outcome measures were pain intensity (NRS) reduction of 33%, the wish to continue TENS and the Patient Global Impression of Change (PGIC). Follow-up was 6-8 weeks after the initiation of TENS therapy. The association of baseline variables and outcome parameters were studied using multivariable regression analyses.

Results
Results: Out of 124 study participants, 99 patients (80%) responded to all questionnaires. In the analysis, 15.3% (n=19) had a pain reduction of 33%, 66.7% (n=66) wished to continue TENS treatment and 56.6% (n=56) experienced general improvement. In the multivariable logistic regression analyses, BMI>25, higher patients' expectations and a higher CSI were significantly associated with a general improvement according to the PGIC. BMI>25 and higher patients' expectations were also associated with the wish to continue TENS. Finally, patient expectations were associated with a pain reduction of 33%.

Conclusion
Conclusions: Several factors were associated with TENS therapy outcomes in chronic pain and low backpain patients. Higher patients' expectations, probably through placebo-mediated mechanisms, and higher BMI are most predictive for a positive TENS outcome. These findings could help with clinical decision-making regarding the initiation of TENS therapy.

Detection of inadequate anastomotic perfusion with a handheld vital microscope during colorectal surgery: a case report

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Introduction
Anastomotic leakage (AL) is one of the most feared complications after gastrointestinal surgery. Assessment of anastomotic viability during surgery remains unreliable. Sufficient bowel perfusion is a requisite for anastomotic healing. Handheld vital microscopy (HVM) is non-invasive technique that can directly visualize the intestinal microcirculation during surgery.

Methods
Two patients underwent elective laparoscopic colorectal surgery. During surgery HVM was used to assess bowel perfusion prior to creation of a primary anastomosis.

Results
Although the bowel macroscopically appeared to be well perfused, HVM showed a severely compromised microcirculation. The colon was re-internalized and during the following minutes cyanosis of the bowel occurred which was visually determined by the surgeon. After dissection towards cranially, a new site for the primary anastomosis was chosen. The postoperative period was uncomplicated.

Conclusion
Sufficient bowel perfusion is often mentioned as key in the pathophysiology of AL. HVM is a technique that could potentially aid surgeons in the assessment of microcirculatory perfusion of the bowel during surgery. We report two cases undergoing colorectal surgery in which HVM showed merit in detecting compromised bowel perfusion before creation of a primary anastomosis.

Preoperative multidisciplinary care for frail cardiovascular surgery patients: preliminary results on the influence on surgical decision making and prehabilitation

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Introduction
Older cardiovascular surgery patients are at increased risk for adverse outcomes. Multidisciplinary care may improve preoperative treatment decision-making and prehabilitation.

Methods
Observational cohort study between October 2018 and December 2019, in frail cardiovascular surgical patients ≥70 years. Frailty screening was used to appraise the somatic, functional and psychosocial health status. A multidisciplinary team (MDT) weighed the risk of surgery versus the expected gain in survival or quality of life to guide preoperative decision making, and initiated a tailored prehabilitation program. Primary endpoint was change of treatment. Secondary endpoints were prehabilitation measures and overall survival.

Results
97 patients were referred for MDT care, 28 (28.9%) vascular surgery patients and 69 (71.1%) cardiac surgery patients. Mean age was 77.8 years. 14 (14.4%) patients were frail in all domains, which was significantly associated with mortality (P=0.001). In 30 (30.9%) MDT patients the initial treatment plan was changed: 14 patients underwent less invasive procedures and 16 patients received conservative treatment. 9 (9.3%) patients pro-

ceeded with surgery without need for prehabilitation. Common prehabilitation measures were: treatment of anemia (43.3%), physical therapy (58.8%) and nutritional management by a dietitian (39.2%). In total, 9 (10.3%) patients had died after one year; 5 patients in the prehabilitation group (8.6%), 4 in the conservative group (25.0%) and 1 in the alternative treatment group (7.1%).

Conclusion
Preoperative multidisciplinary care for frail cardiovascular surgery patients facilitates surgical decision making and prehabilitation. Future research should focus on the impact of MDT care on postsurgical outcome.

Intestinal Mucosal and Serosal Microcirculation at the Planned Anastomosis during Abdominal Surgery

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Introduction
Intestinal blood flow is often named as a key factor in the pathophysiology of anastomotic leakage. The distribution between mucosal and serosal microperfusion during surgery remains to be elucidated. The aim of this study was to assess if the mucosal microcirculation of the intestine is more vulnerable to a surgical hit than the serosal microcirculation during surgery.

Methods
In an observational cohort study (n = 9 patients), the microcirculation of the bowel serosa and mucosa was visualized with incident dark-field imaging during surgery. At the planned anastomosis, the following microcirculatory parameters were determined: microvascular flow index (MFI), percentage of perfused vessels (PPV), perfused vessel density (PVD), and total vessel density (TVD). Data are presented as median (interquartile range [IQR]).

Results
Perfusion parameters and vessel density were significantly higher for the mucosa than the serosal microcirculation at the planned site for anastomosis or stoma. Mucosal MFI was 3.00 (IQR 3.00-3.00) compared to a serosal MFI of 2.75 (IQR 2.21-2.94), p = 0.03. The PPV was 99% (IQR 98-100) versus 92% (IQR 66-94), p = 0.01. The TVD was 16.77 mm/mm2 (IQR 13.04-18.01) versus 10.42 mm/mm2 (IQR 9.36-11.81), p = 0.01, and the PVD was 15.44 mm/mm2 (IQR 13.04-17.78) versus 9.02 mm/mm2 (IQR 6.43-9.43), p = 0.01.

Conclusion
The mucosal microcirculation was preserved, while lower perfusion of the serosa was found at the planned anastomosis or stoma during surgery. Further research is needed to link our observations to the clinically relevant endpoint of anastomotic leakage.

Chronic pain and localized hypoesthesia following laparoscopic adrenalectomy: prevalence and impact on quality of life

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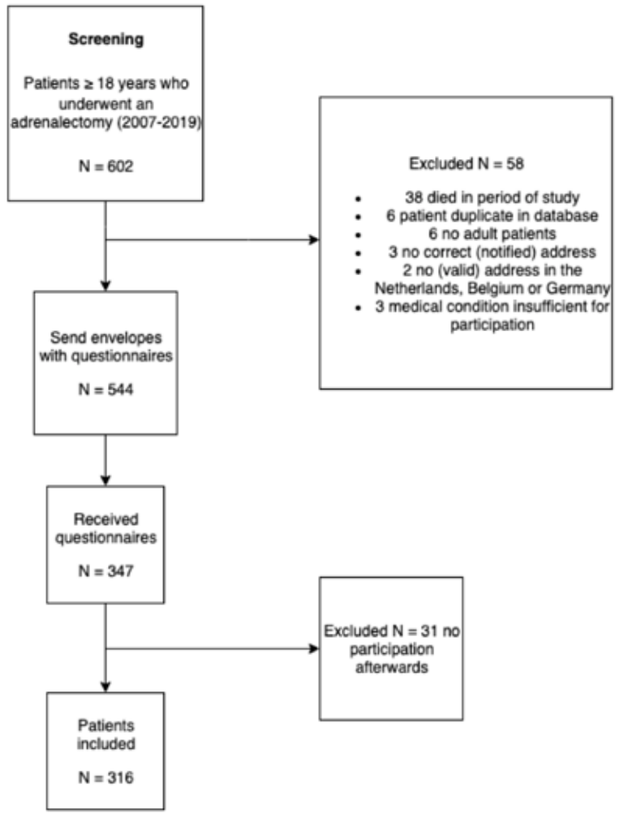
Introduction
Laparoscopic adrenalectomy (LA) is the standard of care for the removal of benign adrenal tumours, in which the transperitoneal and retroperitoneal approach are the major routes to the adrenal gland. Chronic postsurgical pain (CPSP) and sensory alterations are frequently seen after surgery, but the prevalence after LA is unknown.

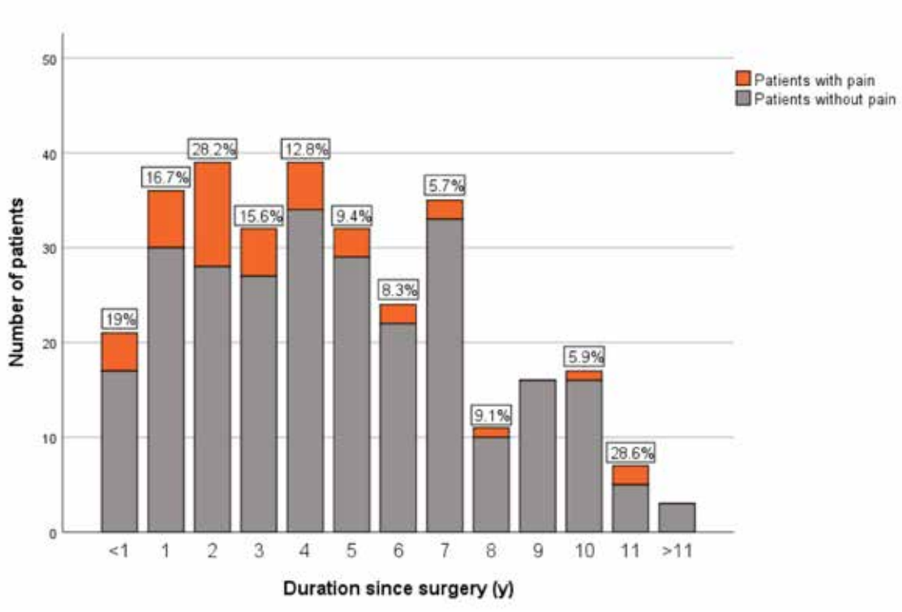
Methods
Five hundred forty-four patients who underwent LA at the Radboudumc (2007 – 2019) were approached for participation. Candidates were asked to complete three questionnaires: the McGill Pain Questionnaire, a questionnaire on hypoesthesia, and the RAND SF-36 to quantify health-related quality of life (HRQoL). Multiple logistic regression was used to identify predictors of CPSP and hypoesthesia.

Results
We received response from 63.8% of which 316 signed informed consent. Transperitoneal adrenalectomy was performed in 53% of cases. The prevalence of CPSP following LA was 14.2% (45/316). Of localized hypoesthesia it concerned 15.5% (49/316). The highest prevalence was reported with a follow-up time from two to four years since surgery in both groups (48.9% and 44.9% respectively). Predictors of CPSP were: younger age, higher BMI, left sided and transperitoneal adrenalectomy (instead of retroperitoneoscopic) and shorter time from surgery in years. Younger age and use of the retroperitoneal approach were predictors of developing hypoesthesia. Patients with CPSP had a significantly impaired HRQoL when compared to patients without chronic pain. The presence of hypoesthesia did not affect HRQoL.

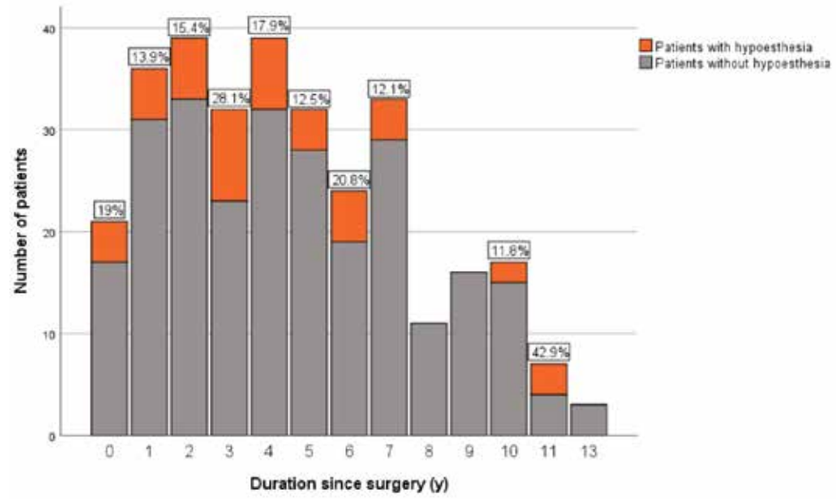
Conclusion
The prevalence of chronic pain and localized hypoesthesia following LA is substantial and patients should be well informed preoperatively about the risks. The retroperitoneal approach was associated with a lower prevalence of CPSP and a higher prevalence of localized hypoesthesia. Future prospective studies are necessary to confirm that the retroperitoneal approach provides better HRQoL as compared to the transperitoneal technique.



Figuur 1: *Patient enrollment*



Figuur 2: *Prevalence of chronic pain per period of follow-time*



Figuur 3: *Prevalence of hypoesthesia per period of follow-up*

	All patients N = 316	Patients with pain N = 45	Patients with hypoesthesia N = 49
Age during surgery (y)	54.2 ± 12.3	50.3 ± 12.1	50.4 ± 9.8
Gender (male)	169 (53.5%)	19 (42.2%)	21 (42.9%)
BMI (kg m^{-2})	27.8 ± 4.7	29.5 ± 5.9	27.4 ± 5.5
Indication of adrenalectomy	N (%)		
PHA	157 (49.7)	17 (37.8)	23 (46.9)
Pheochromocytoma	72 (22.8)	14 (31.1)	20 (40.8)
M. Cushing	42 (13.3)	8 (17.8)	3 (6.1)
Incidentaloma	25 (7.9)	5 (11.1)	1 (2.0)
Malignancy	18 (5.7)	1 (2.2)	1 (2.0)
Cysts	2 (0.6)	0	0
Myelolipoma	2 (0.6)	0	1 (2.0)
Side of adrenalectomy (left / right / both)	132 (41.8%) / 122 (38.6%) / 17 (5.4%)	29 (64.4%) / 13 (28.9%) / 3 (6.7%)	23 (46.9%) / 26 (53.1%) / 0
Type of procedure			
Transperitoneal	168 (53.2%)	31 (68.9%)	18 (36.7%)
Retroperitoneoscopic	148 (46.8%)	14 (31.1%)	31 (63.3%)
Follow-up time since surgery			
<2 y	57 (18.0%)	10 (22.2%)	9 (18.4%)
2-4 y	111 (35.1%)	22 (48.9%)	22 (44.9%)
5-6 y	56 (17.7%)	5 (11.1%)	9 (18.4%)
7-8 y	47 (14.9%)	3 (6.7%)	4 (8.2%)
9-10 y	35 (11.1%)	3 (6.7%)	2 (4.1%)
11-12 y	7 (2.2%)	2 (4.4%)	3 (6.1%)
>12 y	3 (0.9%)	0	0

Categorical variables are presented as n (%); continuous variables are presented as mean ± SD.
BMI body mass index; y years; PHA primary hyperaldosteronism

Tabel 1: *Patient characteristics*

McGill Pain Questionnaire components	Patients with chronic pain N = 45
Start of pain	
Acute	16 (35.6%)
Slowly	27 (60.0%)
Unknown	2 (4.4%)
Patients with hypoesthesia	14 (31.1%)
Course of pain experience	
Pain attacks, with pain-free moments	12 (26.7%)
Continuous, differing in severity	21 (46.7%)
Continuous, stable severity	11 (24.4%)
Unknown	1 (2.2%)
VAS, general (0-100)	33.8 ± 24.5
VAS, least pain (0-100)	14.5 ± 18.3
VAS, worst pain (0-100)	57.5 ± 23.3
Localization of pain	
Flank	27 (42.2%)
Groin	6 (9.4%)
Suprapubic region	1 (1.6%)
Lower back	4 (6.3%)
Upper back	3 (4.7%)
Extremities	12 (18.8%)
Upper abdomen	6 (9.4%)
Other (scrotum, shoulders, head)	5 (7.8%)
Referred pain present	18 (40.0%)
Pain intensity	
NWC-S (0 to 12 words)	2.84 ± 2.84
NWC-A (0 to 5 words)	1.78 ± 1.69
NWC-E (0 to 3 words)	2.20 ± 1.08
NWC-T (0 to 20 words)	8.09 ± 5.00
PRI-S (0 to 36 words)	22.88 ± 15.64
PRI-A (0 to 15 words)	8.99 ± 8.66
PRI-E (0 to 12 words)	10.18 ± 6.01
PRI-T (0 to 63 words)	42.05 ± 26.78

Categorical variables are presented as n (%); continuous variables are presented as mean ± SD. VAS visual analogue scale; NWC–S Number of Words Chosen of the sensory scale; NWC–A, NWC of the affective scale; NWC–E, NWC of the evaluative scale; NWC–T, total NWC; PRI–S, Pain–Rating Index of the sensory scale; PRI–A, PRI of the affective scale; PRI–E, PRI of the evaluative scale; PRI–T, total PRI.

Tabel 2: *Pain characteristics*

Analysis	Number of patients	Mean PRI-T	*P*-value
All patients	45 (of 316)	42.05 ± 26.78	-
Gender			.670
Male	19 (42.2%)	37.40 ± 31.68	
Female	26 (57.8%)	33.30 ± 30.70	
Age (y)			.835
<30	2 (4.4%)		
30-<35	4 (8.9%)	28.83 ± 30.28	
35-<45	4 (8.9%)	35.53 ± 37.82	
45-<55	19 (42.2%)	33.12 ± 28.08	
55-<65	9 (20.0%)	41.96 ± 32.61	
65-<75	7 (15.6%)	40.90 ± 40.22	
BMI (kg/m2)			.857
<25	10 (22.2%)	33.58 ± 29.29	
25-30	18 (40.0%)	36.90 ± 32.94	
>30	17 (37.8%)	34.12 ± 31.22	
Side of adrenalectomy			.920
Left	29 (64.4%)	34.80 ± 28.88	
Right	13 (28.9%)	37.11 ± 38.58	
Bilateral	3 (6.7%)	27.50 ± 5.23	
Type of procedure			.358
Transperitoneal	31 (68.9%)	32.07 ± 30.91	
Retroperitoneoscopic	14 (31.1%)	41.41 ± 30.82	
Time since surgery (y)			.665
<2 y	10 (of 57 patients)	45.56 ± 20.26	
2-4 y	22 (of 111 patients)	40.70 ± 28.73	
5-6 y	5 (of 56 patients)	48.56 ± 36.94	
7-8 y	3 (of 47 patients)	26.83 ± 7.76	
9-10 y	3 (of 35 patients)	44.20 ± 42.28	
11-12 y	2 (of 7 patients)	42.65 ± 16.90	
>12 y	0 (of 3 patients)	-	

Data were analyzed using analysis of variance (ANOVA). Variables are presented as mean ± SD. PRI-T total pain–rating index (score 0-63 words).

Tabel 3: *PRI-T subgroup analysis*

Parameters	Univariable analysis OR (95% CI)	*P*-value	Multivariable analysis OR (95% CI)	*P*-value
Age at time of surgery	0.971 (0.946 – 0.996)	.022	0.946 (0.918 – 0.975)	**.000**
Gender (male)	0.589 (0.311 – 1.116)	.105	-	**-**
BMI (kg/m²)	1.083 (1.017 – 1.154)	.013	1.079 (1.009 – 1.153)	**.026**
Side of adrenalectomy (left)	2.062 (1.025 – 4.148)	.042	2.275 (1.071 – 4.829)	**.032**
Type of procedure (retroperitoneal)	0.462 (0.235 – 0.906)	.025	0.389 (0.183 – 0.826)	**.014**
Duration of surgery	1.003 (0.996 – 1.010)	.418	-	**-**
Time from surgery (y)	0.883 (0.789 – 0.988)	.030	0.805 (0.710 – 0.913)	**.001**

Significant P-values are in bold. d days; LA laparoscopic adrenalectomy; OR odds ratio; y years; 95% CI 95% confidence interval

Tabel 4: *Univariable and multivariable regression analysis for chronic pain following LA*

Hypoesthesia components	Patients with hypoesthesia N = 49
Start of hypoesthesia	
Acute	27 (55.1%)
Slowly	17 (34.7%)
Unknown	5 (10.2%)
Patients with chronic pain	14 (28.6%)
Time since surgery (y)	
<2 y	9 (of 57 patients)
2-4 y	22 (of 111 patients)
5-6 y	9 (of 56 patients)
7-8 y	4 (of 47 patients)
9-10 y	2 (of 35 patients)
11-12 y	3 (of 7 patients)
>12 y	0 (of 3 patients)
Localization of hypoesthesia	
Flank	25 (51%)
Groin	7 (14.3%)
Suprapubic region	2 (4.1%)
Lower back	1 (2%)
Extremities	8 (16.3%)
Upper abdomen	6 (12.2%)
Referred hypoesthesia present	7 (14.3%)
Tingling present	22 (44.9%)
Hypoesthesia continuously present	20 (40.8%)
Hypoesthesia feels annoying	
No	32 (65.3%)
Little	8 (16.3%)
Fairly	5 (10.2%)
Very	3 (6.1%)
Unknown	1 (2.0%)

Categorical variables are presented as n (%)

Tabel 5: *Hypoesthesia characteristics*

Parameters	Univariable analysis OR (95% CI)	*P*-value	Multivariable analysis OR (95% CI)	*P*-value
Age at time of surgery	0.971 (0.947 – 0.995)	.019	0.972 (0.948 – 0.997)	**.030**
Gender (male)	0.603 (0.326 – 1.116)	.107	-	-
BMI (kg/m²)	0.977 (0.914 – 1.044)	.487	-	-
Side of adrenalectomy (left)	0.699 (0.378 – 1.292)	.253	-	-
Type of procedure (retroperitoneal)	2.208 (1.177 – 4.142)	.014	2.112 (1.120 – 3.981)	**.021**
Duration of surgery (d)	0.999 (0.992 – 1.006)	.776	-	-
Time from surgery	0.940 (0.848 – 1.041)	.234	-	-

Significant P-values are in bold. d days; LA laparoscopic adrenalectomy; OR odds ratio; y years; 95% CI 95% confidence interval

Tabel 6: *Univariable and multivariable regression analysis for hypoesthesia following LA*

RAND SF-36 subscales (%)	Whole group N = 312	Patients with pain N = 42	Patients without pain N = 270	*P*-value	Patients with hypoesthesia N = 49	Patients without hypoesthesia N = 263	*P*-value
Physical functioning	78.2 ± 25.2	57.8 ± 26.6	81.2 ± 23.7	**.000**	73.2 ± 30.7	79.1 ± 24.1	.120
Role limitations due to physical health problems	71.1 ± 41.2	36.6 ± 41.9	76.4 ± 38.5	**.000**	72.5 ± 41.8	70.9 ± 41.2	.832
Role limitations due to emotional problems	83.8 ± 33.0	60.2 ± 43.6	87.5 ± 29.6	**.000**	80.3 ± 36.0	84.4 ± 32.6	.444
Energy/fatigue	61.5 ± 20.7	44.6 ± 18.9	64.0 ± 19.8	**.000**	60.0 ± 20.1	61.8 ± 20.9	.622
General mental health	76.8 ± 17.3	62.7 ± 21.3	79.0 ± 15.5	**.000**	73.9 ± 15.7	77.4 ± 17.6	.239
Social functioning	83.9 ± 23.8	67.5 ± 28.0	86.3 ± 22.1	**.000**	82.0 ± 23.6	84.2 ± 23.9	.581
Bodily pain	82.3 ± 23.7	58.7 ± 20.4	85.9 ± 22.0	**.000**	78.4 ± 26.3	83.0 ± 23.2	.225
General health perceptions	58.7 ± 23.0	43.1 ± 21.4	61.2 ± 22.3	**.000**	56.4 ± 22.1	59.2 ± 23.2	.462

Significant P-values are in bold. Variables are presented as mean ± SD. HRQoL health-related quality of life.

Tabel 7: *HRQoL after adrenalectomy (RAND SF-36)*