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Title: **Surgical Site Infections in Neurosurgery**

Degree: Master of Medicine (Mmed) in Neurosurgery

Publication Ready Format

University: University of Cape Town

Primary supervisor: Professor Allan Taylor (allan.taylor@uct.ac.za)

World Neurosurgery Submission

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Key words: "surgical site infection" "central nervous system infection" "risk factors for infection" "cranial neurosurgery" "spinal neurosurgery"

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Declaration page:

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Acknowledgements, format, and contributions:

The thesis will be presented in publication ready format.

I acknowledge the contribution of Professor Allan Taylor for his input into the protocol and human research ethics submission, as well as ongoing support through the write up process.

I acknowledge Professor Graham Fieggen for accepting my research question and supporting me through the early stages of the protocol and application to the departmental research committee, as well as pushing me to finish.

Thank you to Dr Ursula Rohlwink for her kind support, advice, and statistical support. Thank you to Josh Fieggen for your effort and advice in statistical support.

Thank you to Groote Schuur Hospital, particularly Shrikant Peters and Belinda Jacobs for their continued support in access to patient information and theatre records.

This research did not receive any specific grant from funding agencies in the public, commercial, or not-for-profit sectors.

Signed by candidate

Sean Tromp
6 July 2022

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Abbreviation's list

SSI	Surgical site infection
UCT	University of Cape Town
ICU	Intensive Care Unit
CSF	Cerebrospinal fluid
CDC	Centre for Disease Control
WHO	World Health Organisation
Hrs	Hours
T	Temperature
WCC	White Cell Count
CRP	C-reactive protein
EVD	External ventricular drain
VPS	Ventriculoperitoneal shunt
ICP	Intra-cranial pressure
DSF	Depressed skull fracture
EDH	Extra-dural haematoma
ASDH	Acute Sub-dural haematoma
CSDH	Chronic sub-dural haematoma
CSSD	Central sterile services department
Mmed	Master of Medicine
HREC	Human Research Ethics Committee
PACS	Picture archiving and communication system
NHLS	National Health Laboratory Services
SWC	Surgical wound classification

Abstract

Background

Surgical site infection (SSI) is associated with a high morbidity and mortality. We sought to define the incidence of SSI at our institution and examine the risk factors for infection.

Methods

An observational, retrospective cross-sectional review of 676 patients older than 13 years old treated at Groote Schuur Hospital in 2019 yielded 842 neurosurgical operations. These were analysed individually to determine SSI rate as well as risk factors globally, and in pathology groups and wound classes. The SSI cases then had further review of microbiology, laboratory markers of infection, clinical, and outcome data.

Results

The overall incidence of SSI was 4,9% per patient. Of these 33 cases, the majority were deep infections (n=28). The incidence was similar across pathology groups, and scheduling status, but operations starting at night had increased risk of infection. Infected wounds had the highest risk for SSI (8,7%) with external ventricular drain (EVD) insertion carrying the highest risk in clean operations (6,5%). Age was a risk factor for superficial SSI, while operative time and cerebro-spinal fluid (CSF) leak were risk factors for deep infection. 36,4% of SSI cases were culture negative. C-reactive protein (CRP) and change in white cell count (WCC) predict deep infection, functional outcome, and hospital length of stay (LOS). The deep SSI group outcomes were 53,6% functionally impaired, and mortality was 21,4%.

Conclusion

The SSI rate of 4,9% compares well with previous studies. Advanced age, contaminated wounds, and EVD's are high risk for later infection. Operative time and CSF leak are potentially modifiable risk factors for SSI. CRP and change in WCC are useful markers for diagnosis and predicting outcome. 75% of deep SSI cases had a poor outcome.

INTRODUCTION

Surgical site infections (SSI) are known to be a serious and common complication among surgically treated patients[1]. They result in increased rates of morbidity and mortality, hospital length of stay, and cost. This recently prompted a global resurgence of interest in surgical site infections [2]. Surgical site infection is a costly complication in both cranial and spinal neurosurgery [3,4].

Although there has been extensive work done on SSI in shunt related procedures, as well as more limited data on non-shunt related infections in other studies, even these series exclude neurotrauma[5]. Without an inclusive cross-sectional study looking at surgical site infection rates in all neurosurgery procedures, we cannot make inferences about risk factors for infections in order to decrease the rates[5]. A comprehensive evaluation of SSI in neurosurgical patients yields wide rates ranging from <1% to 15% depending on surgery and patient characteristics[4].

Certain operations in neurosurgery have a higher infection risk than others. Spine surgery where hardware is left in situ (e.g. spinal fusion) increases infection risk up to 8,7%[12], and hardware in the cerebrospinal fluid (CSF) compartment (e.g. EVD or ventricular shunt) is especially high risk[6].

Despite some studies recommending a post-operative follow up period of 50 days[7], most centres follow the Centre for Disease Control (CDC) and World Health Organisation (WHO) recommendations of following patients for 90 days for deep SSI, and 30 days for superficial infection. Some groups recommended 1 year follow up if an implant remains[8]. A quarter (27%) of SSI are detected in hospital, while the rest present post discharge[9].

There is limited local data[10] looking at infection rates in individual neurosurgical diseases but no comprehensive SSI data from South Africa was found during a PubMed literature review[11].

One well described way to combat SSI is to implement a bundle approach[8,12,13]. Bundles do not always improve the rates of SSI in neurosurgery[8] except in CSF related infections where they have

proven to be effective[14]. If the CSF related infections in our institution are higher than expected literature, then future research may include implementation of a bundle approach.

GSH is a 900-bed tertiary level hospital in Cape Town, South Africa. On average there are 800 neurosurgical operations performed here per year. With a predicted infection rate of 5% from the literature[11] we anticipate around 40 infections.

Primary and secondary aims

The primary aim of this descriptive study is to define the incidence of SSI in the neurosurgery department at Groote Schuur Hospital.

The secondary aims are to identify risk factors for SSI at our institution, assess the usefulness of biochemical markers for infection and to determine the need to implement an SSI bundle.

Materials and Methods

Study Design

The study is a retrospective cross-sectional descriptive study of the patients operated on at Groote Schuur Hospital for a one-year period from Jan – Dec 2019. This is a 900-bed tertiary level hospital in Cape Town, South Africa. The neurosurgery division manages a 6 bed ICU, 6 bed high care, and 26 bed ward.

The study was conducted after approval from the surgical departmental research committee, the human research ethics committee as well as institutional approval from Groote Schuur Hospital.

Patient population

Inclusion criteria were all patients who underwent a neurosurgical operation in theatre, ICU or the emergency unit, including repeat operations. We excluded all children 13 years and younger, as well as all endovascular procedures.

On average there are 800 neurosurgical operations done per year at Groote Schuur Hospital. With a predicted infection rate of 5% in the literature[11] we anticipated around 40 infections.

Clinical Data

Retrospective patient surveillance for SSI monitoring was chosen. The hospital operation register was used for collection of all data entries including age, sex, operative time, start time, and location. Then all cases were individually reviewed by the first author including review of scan images and laboratory results to categorise them into pathology groups, surgical wound classification (SWC), procedure description, implant insertion, presence of surgical drain, and CSF leak or pseudomeningocele. These were then used to test risk factors for infection. The 1984 CDC definition of surgical wound classification (SWC) was used to categorize wounds as clean, clean contaminated, contaminated, or infected[15].

Where a surgical site infection was identified; data on the immune status, SSI category, microbiology, day of diagnosis, number of surgeries, functional outcome, hospital length of stay, and biochemical markers of WCC, CRP, CSF counts, platelets were collected and recorded in a database. This was used for descriptive statistical analysis.

Microbiology and definitions

There are differing opinions in the literature on the definition of infection, especially related to bacterial culture[6,16]. We used an inclusive definition based on the CDC criteria so that we did not under-report our infection rates by excluding culture negative cases. The time frame used for SSI was more than 24 hrs after procedure to exclude pre-existing infection, and onset of infection less than 90 days after procedure (30 days if superficial SSI). If an implant was used, the time was pushed to one year with implant, or 5 days after removal of EVD or intra-cranial monitor. Patients were recorded as having SSI if there were clinical signs of systemic infection (elevated temperature and pulse) and a decision to treat as infection was made based on wound appearance and laboratory results. For superficial SSI patients did not need systemic features of infection. Microbiology cultures and sensitivities were recorded if positive.

Infections were classified in 5 groups: CSF related hardware infection (including up to 5 days after hardware removal), superficial incisional sepsis (infection above fascia or galea), bone flap sepsis, deep organ space (empyema or brain abscess), and deep spinal wound infection.

All cases of infection were reviewed and agreed to by a panel of two senior neurosurgeons.

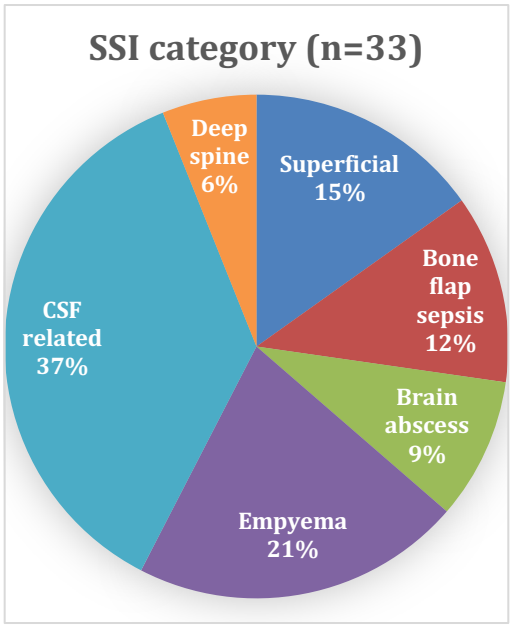
Statistical Analysis

Descriptive statistics were generated based on data distribution, with all normal data presented as a mean (± standard deviation) and all nonnormal data presented as a median [interquartile range]. Default hypothesis testing used Chi-squared test for categorical variables and regular ANOVA testing for continuous data. Hypothesis testing of nonnormal data and small cell counts were accounted for using Kruskal-Wallis and Fisher's exact tests respectively. Data were cleaned in Microsoft excel[17] and analysed in Excel[17] and RStudio[18]. The level of significance was set at 0,05.

Results

Patient specific factors

There were 842 operations performed on 676 unique patients treated by Groote Schuur Hospital Division of Neurosurgery in 2019. Of these 676 patients, 33 developed SSI for an overall SSI rate of 4,9% per patient. Twenty-eight of the SSI's were deep infections and 5 were superficial infections.



The mean age of operated patients was 42,2 (± 16,6). Older age was a risk factor for superficial SSI, with a mean age of 62 in these patients (p<0,001). Overall age was not a risk factor for SSI (p=0,51). There was an overall male predominance of 64% in the patients treated, but no sex difference in SSI rates (p=0,88).

There were 93 patients treated with EVD, and 6 infections yielding a 6,5% infection rate per patient.

Operation specific factors and rates

There were 842 neurosurgery operations performed that were predominantly trauma (38%) and hydrocephalus (22%), then oncology (15%), spine (15%), and vascular work was 2,6%. Most vascular neurosurgery at our institution is done endovascularly (210 procedures in 2019). Of the 842 neurosurgical operations performed, 33 resulted in SSI yielding an SSI rate per operation of 3,9%.

The bone flap sepsis rate from 255 clean craniotomies of all pathology was 3,1%. The SSI rate from 89 contaminated depressed skull fractures that were operated on was 4,5%. Only dirty wounds carried a higher SSI rate of 8,7%. Overall spine infections were 4,5%, but this was higher in the lumbar fusion group at 7,14%.

Operations beginning at night (between 5pm and 7am) showed a trend towards being a risk factor for SSI; 38% of non-complicating operations began at night compared to 46% of SSIs having the index operation begin at night. Of these night time SSI's, 95% were deep infections.

The scheduling of operations had no impact on the SSI rate; 65% of non-complicating operations were scheduled as emergencies while 64% of operations complicated by SSIs were emergencies (p=1,00).

The ventriculo-peritoneal shunt (VPS) sepsis rate from 84 shunts was 4,8%. There were 105 EVD's placed in 93 patients, with 6 infections resulting in an EVD sepsis rate of 5,7% per EVD.

Two out of 58 ICP monitors developed deep SSIs.

The median operative time was 135min [75-171] in the infection group, compared to the 100min [65-155] in those with no SSI (p=0,14). EVD infections had longer operative times at 65min [55-110] than non-infected cases at 55min [45-75] (p=0,18). Trauma craniotomies that developed SSI had median operative times of 155min [135-250] while the uninfected cases were 110min [84-155] (p=0.08). VPS infections took 101min [100-111] which was similar to non-infected VPS cases that took 98min [79-135] (p=0,50).

The overall drain usage rate in this series was 11,3%. Drain usage did not meaningfully vary in SSIs with 12% of infections having associated drains (p=1,00).

Patient operative data and SSI rates per procedure are summarised in table 1 below[†].

		Total (n=842)	Mean age (years)	Median Op time (min)	Surgical drain	Night case (5pm-7am)	SSI	SSI rate (%) per case
Trauma								
	DSF	89	30	85	0	61	4	4,49
	EDH	66	30	130	16	35	2	3,03
	ASDH	62	50	155	9	36	2	3,23
	CSDH	55	52	55	0	36	2	3,64
	ICP monitor	58	32	60	0	20	2	3,45
Hydrocephalus								
	EVD	105	38	50	0	43	6	5,71
	VPS	84	37	100	0	33	4	4,76
Tumour								
	Resection	105	47	220	3	0	3	2,86
	Biopsy	17	51	50	0	1	0	0,00
Spines								
	Spine tumour	31	46	185	11	1	1	3,23
	Lumbar laminectomy	30	50	88	14	0	1	3,33
	ACDF	28	56	146	27	0	0	0,00
	Degen lumbar fusion	14	54	196	11	0	1	7,14
	Cervical laminectomy	10	53	103	3	0	1	10,00
Vascular								
	ICH evacuation	9	48	93	0	7	1	11,11
	Aneurysm clipping	7	56	155	0	0	0	0,00
	AVM resection	4	28	320	0	0	0	0,00
	Cavernoma resection	1	39	405	0	0	0	0,00

Of the 33 patients with SSI, 3 had poorly controlled diabetes (HBA1c >8%) and 3 were HIV positive with a mean CD4 of 150 (±189). Only one patient had peri-operative radiotherapy complicated by wound dehiscence in a spine tumour case. Twelve patients had albumin measured at presentation with a mean value of 34g/L (normal 35-52g/L).

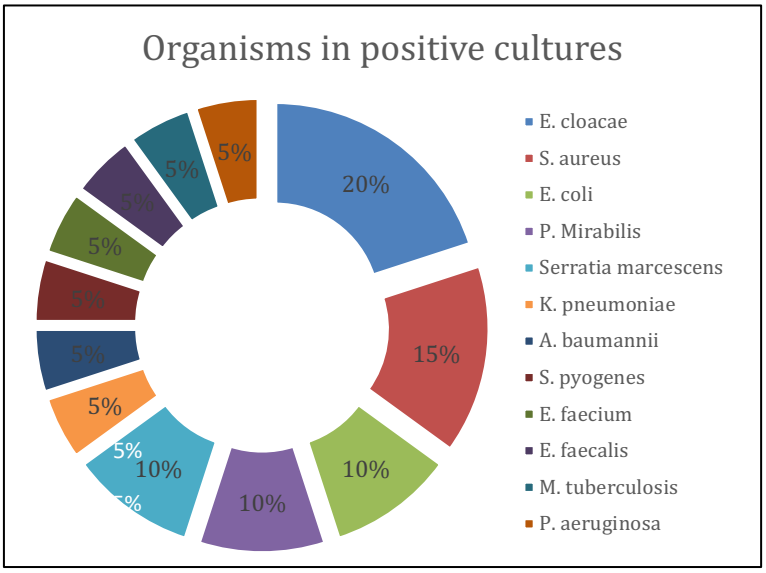
[†] Patient characteristics

A comparison of the clinical features of superficial and deep SSI's is summarised in table 2 below[‡]

		Superficial SSI (n=5)	Deep SSI (n=28)	P-value
Microbiology				
	Blood culture positive	0 (0%)	3 (11%)	NA
	Surgical culture positive	1 (20%)	17 (61%)	0.15
Biochemistry				
	Presentation CRP	25 [11,5-53]	113 [43-225]	**0,03**
	Presentation WCC	12,4 [8,3-12,6]	14,4 [11,3-18,3]	0,07
	Change in WCC	3,9 [-0,2-4,2]	5,3 [3-8,4]	0.06
	Change in platelets	99 [-2-221]	203,5 [39-381]	0.21
Clinical				
	Mean Age	62,2 (± 7,3)	36,4 (± 10,1)	**<0,01**
	Sex (Male)	3 (60%)	19 (68%)	1.00
	POD diagnosed	19 [15-30]	10,5 [8-25]	0.44
	No of surgeries	1 [0-1]	2 [1-3]	0,06
	Hospital LOS	8 [4-11]	32 [16-44]	**<0.01**
Outcome				
	Well	5 (100%)	8 (28,6%)	**0.01**
	Functionally impaired	0 (0%)	15 (53,6%)	NA
	Died	0 (0%)	6 (21,4%)	NA

The post-operative day diagnosed exceeded 90 in 3 cases: a VP shunt placement, an acute sub-dural haematoma with dural substitute and plates, and a chronic sub-dural haematoma with an indolent organism (M. tuberculosis).

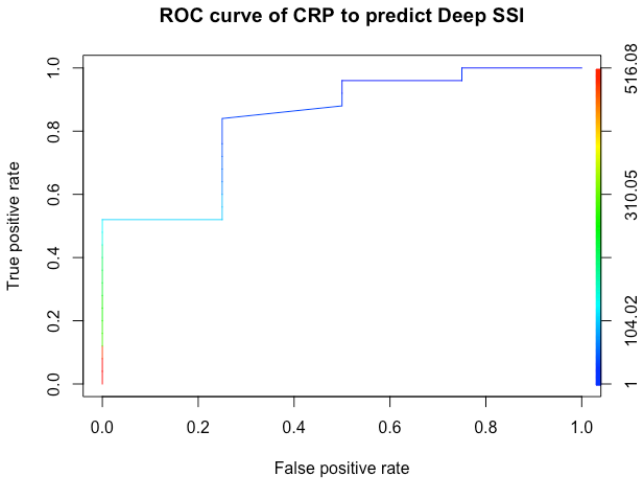
In 3 out of 33 (9%) of the SSI cases no microbiological specimens were sent. Of the 30 patients who had cultures sent there were 18 (60%) positive cultures. Thirteen (68,4%) were gram negative organisms, and six (31,6%) were due to gram positive organisms as in figure 1 [§]. A total of 4 cases



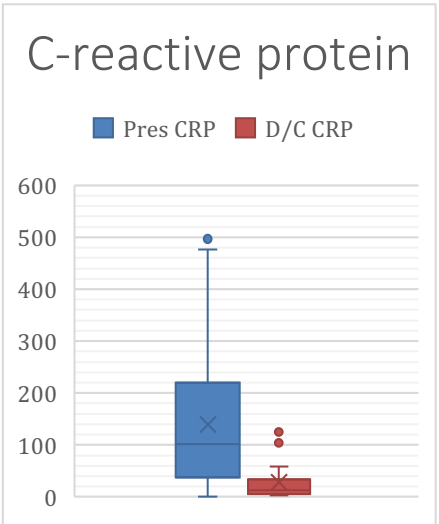
[‡] Clinical features of superficial and deep SSI's
[§] Organisms in positive cultures

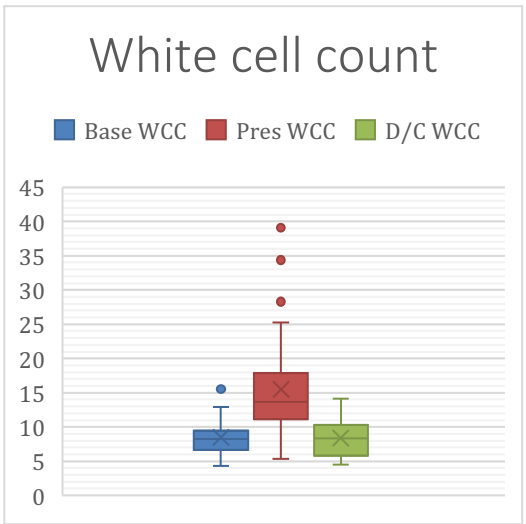
were due to resistant organisms. In 3 cases, two organisms were cultured from the first diagnosis. Twelve of the 33 SSIs were culture negative (36%).

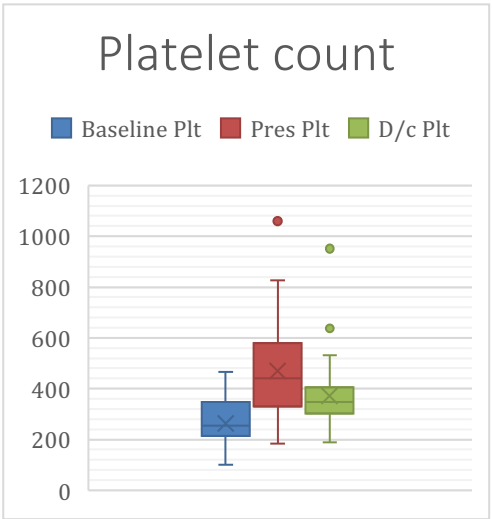
Of the 33 patients with SSI, 29 had a serum C-reactive protein (CRP) test at diagnosis (presentation CRP). The median CRP at diagnosis was 113 [43-225] for deep infections, and 25 [11,5-53] for superficial SSI. Only one superficial SSI had CRP >40, and only 4 of the deep SSI's had CRP <40. A receiver operator characteristic (ROC) curve was used to evaluate the potential value of presentation CRP to predict a deep SSI with a value in the region of 40 being confirmed to be potentially useful[**]. A CRP of >40 had sensitivity of 89% [72-98%] and specificity of 80% [28-99%] in diagnosing deep SSI.



The WCC, and Platelet count were taken at baseline in all but 2 patients. Only 2 patients in the SSI group had ESR at diagnosis, so this marker was excluded. The graphs in figure[**] summarise the mean, median, and interquartile range for these markers[††].

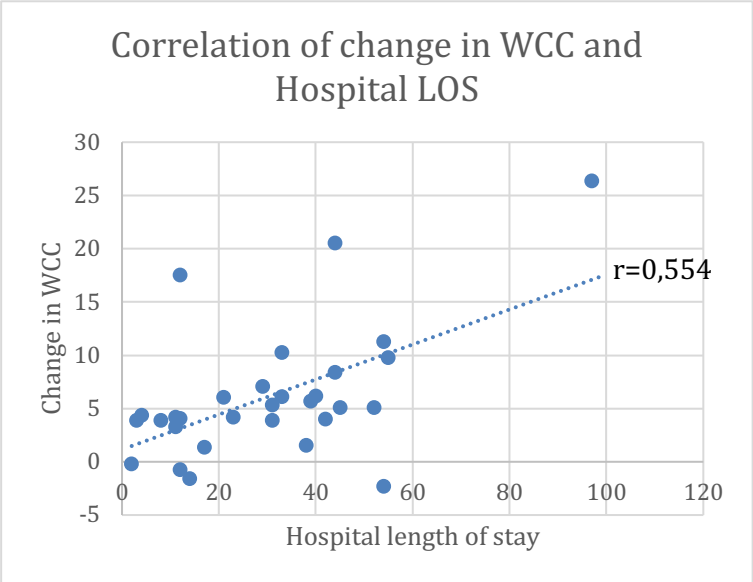






[**] ROC curve of CRP to predict deep SSI
[††] Infective markers in surgical site infection

The hospital length of stay (LOS) has traditionally been used as a marker of severity of infection[17]. In testing the laboratory markers to find the best predictor of hospital length of stay, the Pearson correlation coefficient with the highest value was the change in WCC (r=0,55) followed by the presentation CRP (r=0,51) indicating a moderate correlation. This was depicted in the graph in Fugure[‡‡]:



The CRP and change in white cell count were not only useful in diagnosis of infection, but also in prognosticating for poor outcome. The table [§§] shows the laboratory data and the clinical parameters in the 3 outcome groups of well, functionally impaired, and death:

		Well (n=13)	Functionally impaired (n=14)	Death (n=6)	P-value
Biochemistry					
	Presentation CRP	35 [16-161]	74 [46-250]	141 [128-297]	**0.04**
	Presentation WCC	11,2 [8,9-12,5]	14,4 [11,7-17,9]	26,2 [18,6-32,9]	**<0.01**
	Change in WCC	3,9 [2,3-4,2]	5,2 [3,9-6,8]	11,3 [10,3-17,5]	**<0.01**
	Change in platelets	25,5 [3,3-130]	221 [104-299]	376 [298-413]	**0.01**
Clinical					
	Mean Age	45 (± 15,4)	39 (± 9,0)	33 (± 12,5)	0.15
	Sex (Male)	10 (77%)	7 (50%)	5 (83%)	0.29
	POD diagnosed	17 [10-38]	10 [8-21]	15 [7-24]	0.62
	No of surgeries	1 [0-1]	2 [2-4]	3 [1-4]	**<0.01**
	Hospital LOS	11 [8-17]	40 [31-44]	37 [17-51]	**<0.01**

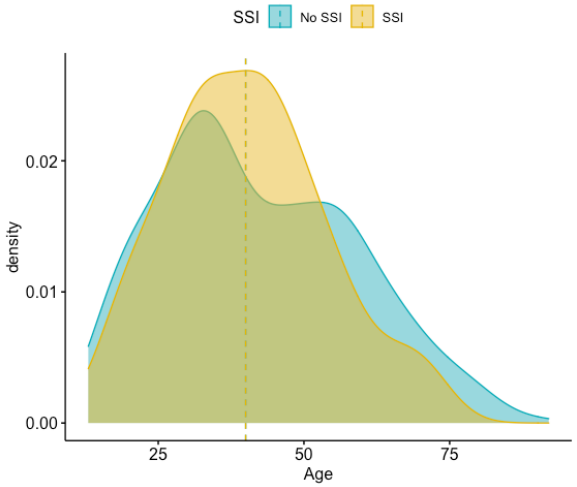
[‡‡] Correlation of change in WCC to hospital length of stay
[§§] Laboratory data and clinical parameters in the three outcome groups

Discussion

SSI is a major determinant of patient outcome and an important measure of an institution's proficiency. High post-operative infection may negate any benefit derived from surgery, so audit of infection rates and correction of any risks identified is an important step to improving outcomes. Studying SSI is not straight forward however as many factors are at play. Patients have different immune status, some have contaminated wounds before surgery, and implants pose a higher infection risk. For these reasons many studies choose to limit selection to one type of operation[16,18] [2](shunt insertion) or exclude patients with wound contamination. In this study however we sought to determine an overall SSI rate and risks that may be associated with infection. In addition, we used a broad definition of SSI to capture as many patients with infection as possible. To confirm no patients are lost to follow up, an SSI surveillance study from 2015 showed that active outpatient follow up is not necessary and monitoring of inpatients and readmissions is enough for SSI follow up in neurosurgery[9].

Despite a large proportion[19] of our operations being emergency cases (65%) and a high prevalence of immune suppression due to HIV infection the reported overall SSI rate of 4,9% compares well with the expected rate of 5% from the literature[11].

In testing risk factors for infection, age was a risk factor for superficial infection alone, and was especially true in spine infections. Age did not have an impact on deep infection in our group as shown in the density plot[***]. This may have confounded the outcome finding that well patients with SSI tended to be older at 45 (±15,4) while those that died were younger with a mean age of 33 (±12,5) years old.



[***] Density plot of age in SSI group compared to no SSI group

The procedures of special interest with regard to infection prevention included bone flap sepsis in clean craniotomies (3,1%), EVD sepsis rate (5,7%), VPS sepsis rate (4,8%), and elective spine infection rate (4,5%). The lumbar fusion SSI rate of 7,14% is in line with published series[12]. There were only 10 cervical laminectomies performed in 2019, and the one superficial infection may overestimate the rate of 10% due to small numbers.

The only wound classification that had a significantly higher SSI rate was infected wounds category as can be expected. Contaminated wounds (mostly compound depressed skull fractures) that are not infected at the time of operation; have infection rates similar to elective operations with aggressive debridement and closure. This underpins the importance of surgical management[21] in this high-risk group to prevent infection.

Prolonged operative time was seen across the board in the SSI group to be a risk factor, which is in line with published series[16,20]. Trauma craniotomies that developed SSI had 40% longer operative times than uninfected cases. EVD insertion similarly was 20% longer in the SSI group per EVD than the un-infected cases.

Starting an operation after hours regardless of scheduling status was an increased risk for SSI. This may be due to junior staff operating with non-neurosurgery trained sisters with longer operative times at night. Emergencies done during the day were not statistically a risk factor for SSI. Our 64% emergency neurosurgery rate was almost double that of other published series[19].

The use of surgical drain was neither protective nor causative in SSI. This is however subject to bias as it was the surgeon's choice to place a surgical drain, and this was most used in trauma craniotomies and spine operations.

CSF leak has traditionally been associated with SSI risk[22], where pseudomeningocele without leak has not. Of the 14 cases of sepsis associated with craniotomy, 2 had CSF leaks and 2 had pseudomeningocele without a CSF leak externally. Of the 5 spine infections, 2 had CSF leak at

presentation. Of the 12 CSF hardware related infections, 5 had CSF leak. This confirms the significant association of CSF leak to surgical site infection.

The microbiology of the culture positive cases was two thirds gram negative organisms and one third gram positive organisms. The definition of infection to include culture negative cases that had a strong clinical suspicion of infection and warranted treatment allowed 12 additional cases (36%) to be included. This means that a third of patients with clinically significant infections in neurosurgery will not be culture positive. The blood culture was only positive in 11% of deep infections.

Laboratory data is important in the diagnosis of surgical site infections[23]. Absolute CRP value is useful for diagnosis especially with deep infections. A CRP of 40 was potentially useful in this series of patients to differentiate deep from superficial infections. Related to this, the CRP and WCC can prognosticate into those who will have a good or poor outcome. CRP is also useful for assessing response to treatment. The absolute WCC at diagnosis is not as useful in diagnosing infection, but the change in WCC from a baseline to that taken at diagnosis added to the diagnosis. A change in WCC of >10 can also warn of possible poor outcome with a median change in WCC of 11 in those who died. Similarly, the change in platelet count has some use in diagnosing infection, but as the count tends to stay up at discharge is not useful in deciding on end of treatment. The CSF pleocytosis is useful in CSF infection, but in one case we had proven ventriculitis on culture from catheter tip and CSF, without pleocytosis.

Of interest is that the diagnosis of SSI was delayed in 3 cases. The median post-operative day of diagnosis was 19 days for superficial SSI, and 11 days for deep SSI. As seen from the outcomes, the significant infections (deep infections in patients that end up functionally impaired or die) tend to present earlier than the superficial infections in well patients. Perhaps the routine surgical wound check at 10 days post op is too soon to reassure against significant infection, by which time only 50% of the deep infections will have presented.

The outcome of superficial SSI was reassuring, with all 5 patients well at discharge. However, the outcome of deep SSI was concerning, with 4-fold increase in hospital length of stay, and only 28,6% of patients well at discharge, 53,6% functionally impaired, and 21,4% mortality.

The limitations of the study are that there were no patients younger than 13 years old, as they are treated at a separate hospital. They do represent a major burden of SSI in the hydrocephalus group especially. It will be important for future research to repeat this cross-sectional study at the paediatric hospital and to compare the groups.

Conclusions

The overall infection rate was acceptable at 4.9% per patient treated. In the important surgical groups of clean craniotomies, VPS, and elective spinal work, the SSI rate was under 5% per operation. The clean operations with highest risk for deep infections were EVD and lumbar spine fusions. Advancing age is a risk factor for superficial SSI. Operative time and CSF leak were risk factors for deep SSI. Surgical drain use did not impact on SSI. 36,4% of the SSI's were culture negative, underpinning the importance of the definition. Blood culture does not seem to be useful in neurosurgical SSI. Significant infections tend to present around 10 days post-operative but can be delayed. Both presentation CRP and change in WCC can be useful in diagnosis of deep SSI, as well as for predicting hospital length of stay and outcome, and response to treatment. The deep SSI group had prolonged hospital LOS and poor outcomes with 53,6% functionally impaired, and 21,4% mortality.

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Appendices

Categories for data collection on all patients ("All Data") and those with an identified surgical site infection ("SSI cases"). This will be in the form of an excel spread sheet with two data sheets

Categories: All data

1. Date of procedure
2. Surname
3. Folder number
4. Date of birth
5. Sex
6. Pathology (grouping)
7. Scheduled time (day or night)
8. Procedure (grouping)
9. Number of surgeons
10. Duration of procedure (surgical time)
11. Wound classification
12. Implants

Additional Categories: SSI cases

1. Immune status (compromised Y/N)
2. Chemotherapy or radiation therapy
3. Surgical drain
4. Post op CSF leak
5. Albumin at presentation
6. WCC at SSI presentation

7. CRP at SSI presentation
8. SSI category
9. CSF polymorph count at diagnosis
10. POD diagnosed
11. Microbiology
12. Sensitivities
13. Management of complication
14. Clinical outcome
15. Hospital length of stay

UNIVERSITY OF CAPE TOWN
Faculty of Health Sciences
Human Research Ethics Committee

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Website: www.health.uct.ac.za/fhs/research/humanethics/forms

31 March 2021

HREC REF: 188/2021

Prof A Taylor
Division of Neurosurgery
Red Cross War Memorial Children's Hospital
Email: Allan.taylor@uct.ac.za
Student: trmsea001@myuct.ac.za

Dear Prof Taylor

PROJECT TITLE: SURGICAL SITE INFECTIONS IN NEUROSURGERY-MMED CANDIDATE-DR SEAN TROMP

Thank you for submitting your study to the Faculty of Health Sciences Human Research Ethics Committee (HREC)for review.

It is a pleasure to inform you that the HREC has **formally approved** the above-mentioned study.

This approval is subject to strict adherence to the HREC recommendations regarding research involving human participants during COVID -19, dated 17 March 2020 & 06 July 2020.

Approval is granted for one year until the 30 April 2022.

Please submit a progress form, using the standardised Annual Report Form if the study continues beyond the approval period. Please submit a Standard Closure form if the study is completed within the approval period.
(Forms can be found on our website: www.health.uct.ac.za/fhs/research/humanethics/forms)

The HREC acknowledge that the student: Dr Sean Tromp will also be involved in this study.

Please quote the HREC REF 188/2021 in all your correspondence.

Please note that the ongoing ethical conduct of the study remains the responsibility of the principal investigator.

Please note that for all studies approved by the HREC, the principal investigator **must** obtain appropriate institutional approval, where necessary, before the research may occur.

Yours sincerely

PROFESSOR M BLOCKMAN
CHAIRPERSON, FACULTY OF HEALTH SCIENCES HUMAN RESEARCH ETHICS COMMITTEE

UNIVERSITY OF CAPE TOWN

Department of Surgery
Departmental Research Committee
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11 Feb 2018

Dr S Tromp

Department of Surgery
University of Cape Town

Dear Dr Tromp

RE: Project 2018/014

PROJECT TITLE: Surgical Site Infections In Neurosurgery

The above protocol has been reviewed by the Department of Surgery Research Committee. I am pleased to inform you that the committee approved the scientific merit of the study, and endorse the protocol for submission to the relevant ethics committee.

Although this letter serves as confirmation that the above protocol has successfully passed through the surgical DRC, respective ethics committees still require DRC chair signature before submission.

Please use the above project number in all future correspondence,

Yours sincerely

DR TIMOTHY PENNEL
CHAIRMAN: RESEARCH COMMITTEE

Western Cape Government
Health

GROOTE SCHUUR HOSPITAL
Enquiries: Dr Bernadette Eick
e-mail: GSHReserach.Request@westerncape.gov.za

Professor Allan Taylor
SURGERY - NEUROSURGERY

E-mail: allan.taylor@uct.ac.za / trmsea001@myuct.ac.za

Dear Professor Taylor,

RESEARCH PROJECT: Surgical Site Infections In Neurosurgery (MMed. Dr Sean Tromp)

Your recent letter to the hospital refers.

You are granted permission to proceed with your research, which is valid until **30 April 2022.**

Please note the following:

a) Your research may not interfere with normal patient care.
b) Hospital staff may not be asked to assist with the research.
c) Confidentiality must always be maintained.
d) No additional costs to the hospital should be incurred as indicated in your Annexure 2 i.e. Lab, consumables or stationery. **If access to TRACK Care/NHLS is required, kindly attach our letter of approval to the application form and approach Information Management to assist with data.**
e) **No patient folders may be removed from the premises or be inaccessible.**
f) Please provide the research assistant/field worker with a copy of this letter as verification of approval.
g) Should you at any time require photographs of your subjects, please obtain the necessary indemnity forms from our Public Relations Office (E45 OMB or ext. 2187/2188).
h) Should you require additional research time beyond the stipulated expiry date, please apply for an extension.
i) Please discuss the study with the HOD before commencing.
j) Please introduce yourself to the person in charge of an area before commencing.
k) On completion of your research, please forward any recommendations/findings that can be beneficial to use to take further action that may inform redevelopment of future policy / review guidelines.
l) Please contact Michelle Riley (Patient Fees) at ext. 2276 to ascertain if there will be charges for conducting the Research and to obtain a quote or to discuss charges
m) Kindly submit a copy of the publication or report to this office on completion of the research.
n) At no time should any posters encouraging patients to partake in research, be displayed within a clinical area.
o) Please adhere to ALL COVID-19 regulations and Groote Schuur Hospital policies.

I would like to wish you every success with the project.

Yours sincerely

***p.p.* DR BERNADETTE EICK**
CHIEF OPERATIONAL OFFICER
Date: 29 April 2021

C.C. Mr. L. Naidoo / Dr B. Jacobs / Professor G. Fieggen