The 13th World Congress on Infection Prevention and Control
Rome - Italy

Surveillance Findings of Surgical Site Infections among Pediatric Surgeries at a Specialized Teaching Hospital, Sudan 2016

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INTRODUCTION

- **Health care associated infections** estimated global prevalence ranges between **10% to 15.5%.** (WHO, 2011)

Impact:

- Prolonged hospital stay
- Long term disability
- Increased resistance to antimicrobials
- High costs for patients and their families
- Massive additional financial burden for health systems
- Excess deaths. (Suzanne M, Pear R, 2007)

- **Surgical site infections (SSI)** are the **most frequent** in low and middle income countries (25% - 29%) of HCAI where (60%) of them are preventable. (WHO, 2009-2011)

- Scarce data on Pediatrics SSI

Surveillance of SSI:

- Measures the magnitude of the problem
- Enables implementation of evidence based interventions that significantly reduces the rates subsequently. (JCI, 2013)

Principle concepts to prevent and reduce the risk for SSI:

- Engagement of senior leadership and physicians.
- Education of surgeons, nurses, patients and families.
- Execution and implementation of evidence based surgical practices.
- Evaluating the effectiveness of implementing strategies of preventing SSI through measurement tools.(Keping Cheng JL, Qingfang Kong, et al, 2015)

Situation in Sudan

- Federal Ministry of Health has planned to establish a national surveillance system for HCAI
- The national burden is unknown
- Few published studies nationally in the field of IPC and specifically on SSI

General Objective

To study surveillance findings of surgical site infections at paediatrics surgery department at a specialized teaching hospital 2016.

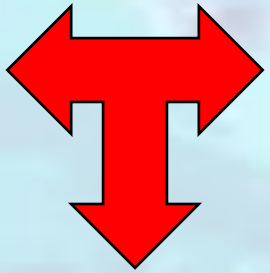
Specific Objectives

1. To measure the incidence rates of SSIs.
2. To determine associated surgical factors for developing SSIs.
3. To calculate the risk index for prediction of SSIs using NNIS risk index criteria.

Developing Direct Active SSI surveillance System (CDC guidelines of SSI surveillance)

STEP 1

Orientation of surgeons and anesthetists on SSI surveillance and risk index



Educate guardians on SSI symptoms and follow up processes

Training of research team (nurses , doctors) on SSI surveillance

Running Direct Active SSI surveillance

Post discharge surveillance for 1 month

Phone calls/Readmission/Referred clinic visits

STEP 2

STEP 3

Analysis of surveillance findings

Feed back

NNIS Risk index parameters

Parameter	Finding	Points
ASA preoperative assessment	1 or 2	0
	3, 4 or 5	1
Duration of operative procedure	<= 75th percentile for procedure	0
	> 75th percentile for procedure	1
Surgical wound class	clean or clean-contaminated	0
	contaminated or dirty	1

NNIS Risk index parameters

American Society of Anesthetists classification of patient clinical condition

ASA class	Physical status
ASA 1	A normal healthy patient
ASA 2	A patient with mild systemic disease
ASA 3	A patient with severe systemic disease
ASA 4	A patient with severe systemic disease that is a constant threat to life
ASA 5	A moribund patient who is not expected to survive without the operation

Inclusion

All pediatric patients aged (1day – less than 15 years)

Electively and emergency operated patients

Both male and female patients

Exclusion

Patients underwent operations including implant/organ transplant.

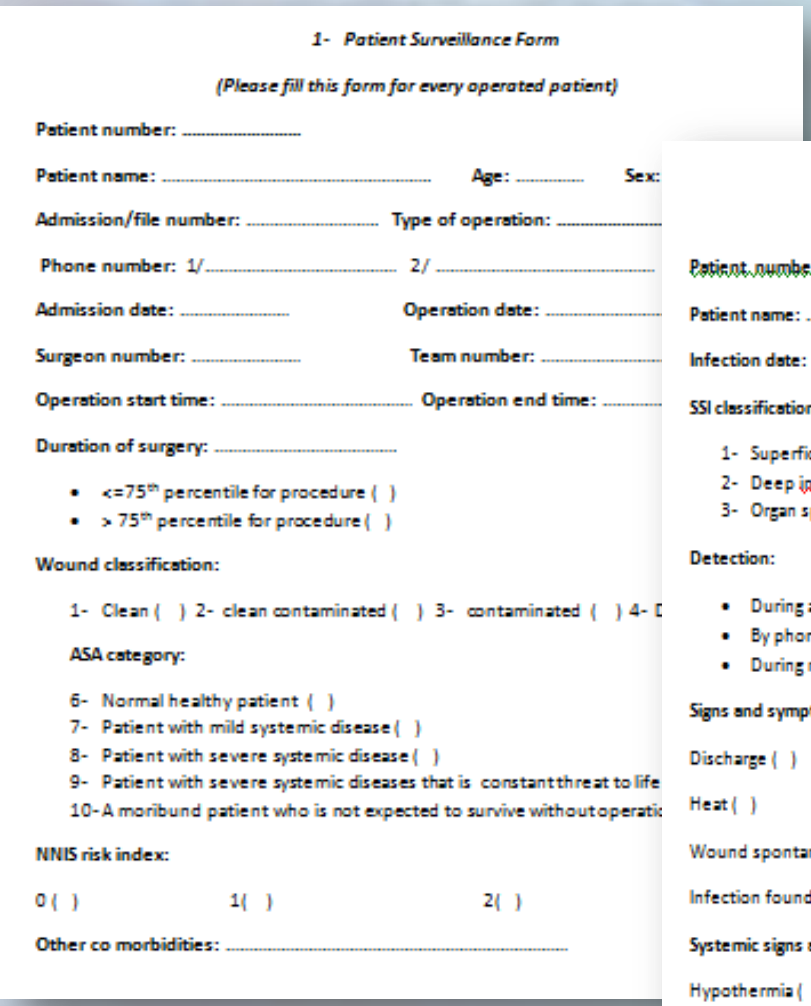
Referred patients

Sampling

- All admitted patients (191) were monitored and only operated patients were enrolled.
- A total of (159) children were meeting the inclusion criteria and were enrolled in the study and were followed during the enrollment and follow up period

(1st June – 31st August 2016)

Data collection tools



1- *Patient Surveillance Form*

(Please fill this form for every operated patient)

Patient number: .....

Patient name: ..... **Age:** ..... **Sex:**

Admission/file number: ..... **Type of operation:** .....

Phone number: 1/..... 2/ .....

Admission date: ..... **Operation date:** .....

Surgeon number: ..... **Team number:** .....

Operation start time: ..... **Operation end time:** .....

Duration of surgery: .....

- <=75th percentile for procedure ( )
- > 75th percentile for procedure ( )

Wound classification:

1- Clean ( ) 2- clean contaminated ( ) 3- contaminated ( ) 4- D

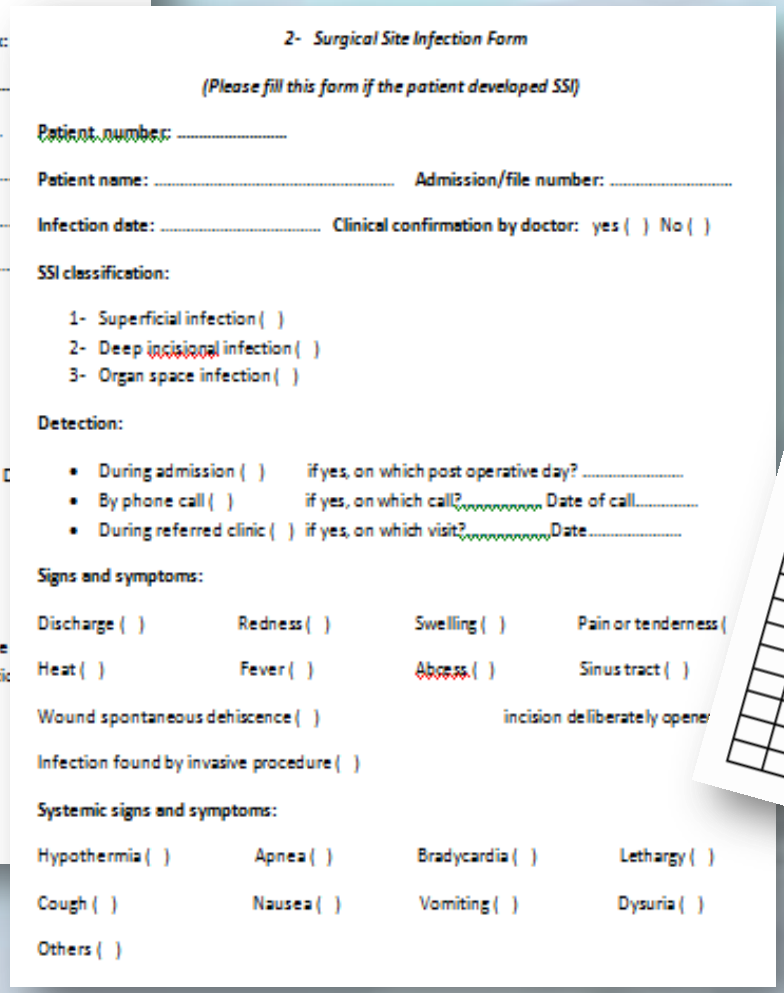
ASA category:

6- Normal healthy patient ( )
7- Patient with mild systemic disease ( )
8- Patient with severe systemic disease ( )
9- Patient with severe systemic diseases that is constant threat to life
10- A moribund patient who is not expected to survive without operatic

NNIS risk index:

0 ( ) 1( ) 2( )

Other co morbidities: .....



2- *Surgical Site Infection Form*

(Please fill this form if the patient developed SSI)

Patient number: .....

Patient name: ..... **Admission/file number:** .....

Infection date: ..... **Clinical confirmation by doctor:** yes ( ) No ( )

SSI classification:

1- Superficial infection ( )
2- Deep incisional infection ( )
3- Organ space infection ( )

Detection:

- During admission ( ) if yes, on which post operative day? .....
- By phone call ( ) if yes, on which call?..... Date of call.....
- During referred clinic ( ) if yes, on which visit?..... Date.....

Signs and symptoms:

Discharge ( ) Redness ( ) Swelling ( ) Pain or tenderness (

Heat ( ) Fever ( ) Abcess ( ) Sinus tract ( )

Wound spontaneous dehiscence ( ) incision deliberately opene

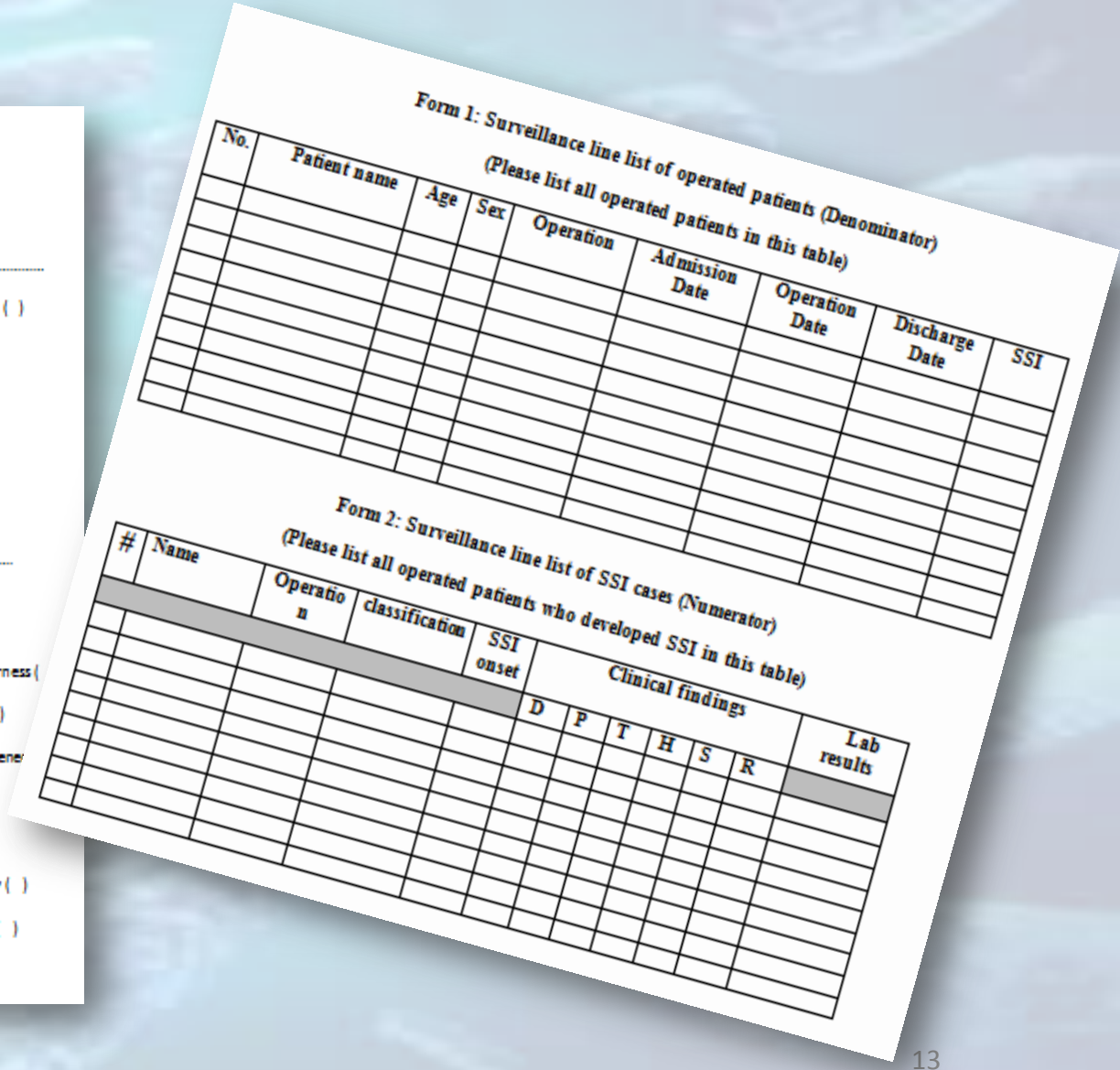
Infection found by invasive procedure ( )

Systemic signs and symptoms:

Hypothermia ( ) Apnea ( ) Bradycardia ( ) Lethargy ( )

Cough ( ) Nausea ( ) Vomiting ( ) Dysuria ( )

Others ( )



Form 1: Surveillance line list of operated patients (Denominator)

(Please list all operated patients in this table)

No.	Patient name	Age	Sex	Operation	Admission Date	Operation Date	Discharge Date	SSI

Form 2: Surveillance line list of SSI cases (Numerator)

(Please list all operated patients who developed SSI in this table)

#	Name	Operation	classification	SSI onset	Clinical findings						Lab results
					D	P	T	H	S	R	

Form 3: Follow up sheet (post operative daily clinical evaluation)

(Please fill this form for every operated patient separately and register the daily findings)

Name		Age		Sex		Operation	
Admission Date		Operation date				Discharge Date	
		Clinical findings					
Day	D	P	T	H	S	R	
1							
2							
3							
4							
5							

Form 4: Follow up sheet (Phone calls 1-2)

(Please fill this form for each patient. First call between 2nd and 3rd week and second call between 3rd and 4th week)

Name		phone	1/ 2/	Operation	
Admission Date		Operation Date		Discharge Date	
		Symptoms reported by patient			
Call	Date	D	P	T	H	S	R
1							
2							
Doctor advice/ treatment							

Form 5: Follow up sheet (Referred clinic1st visit)

(Please list here all patients visiting the referred clinic)

Clinic date: .....

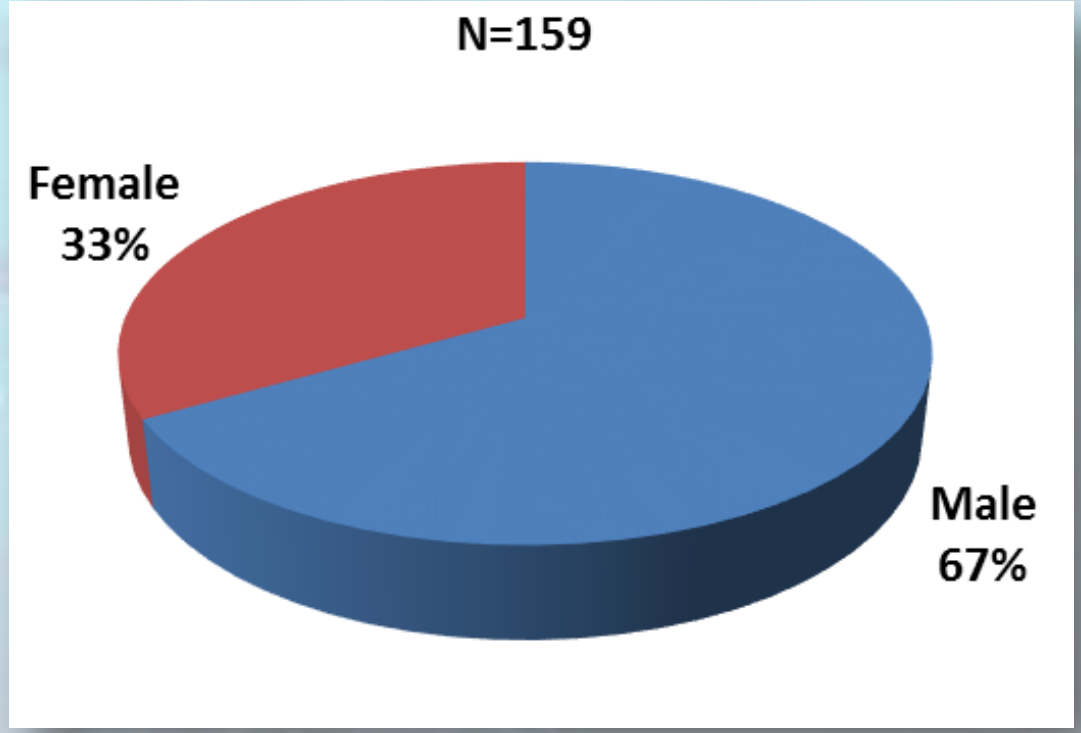
#	Name	Visit #	Operation	Admission Date	Operation Date	Discharge Date	Clinical findings					
							D	P	T	H	S	R

Results

Age distribution of population

Age group	Frequency	Percentage
Less than 1 year	42	26.4%
1 – less than 4 years	49	30.8%
4 – less than 8 years	32	20.1%
8 years to less than 15	36	22.6%
Total	159	100%

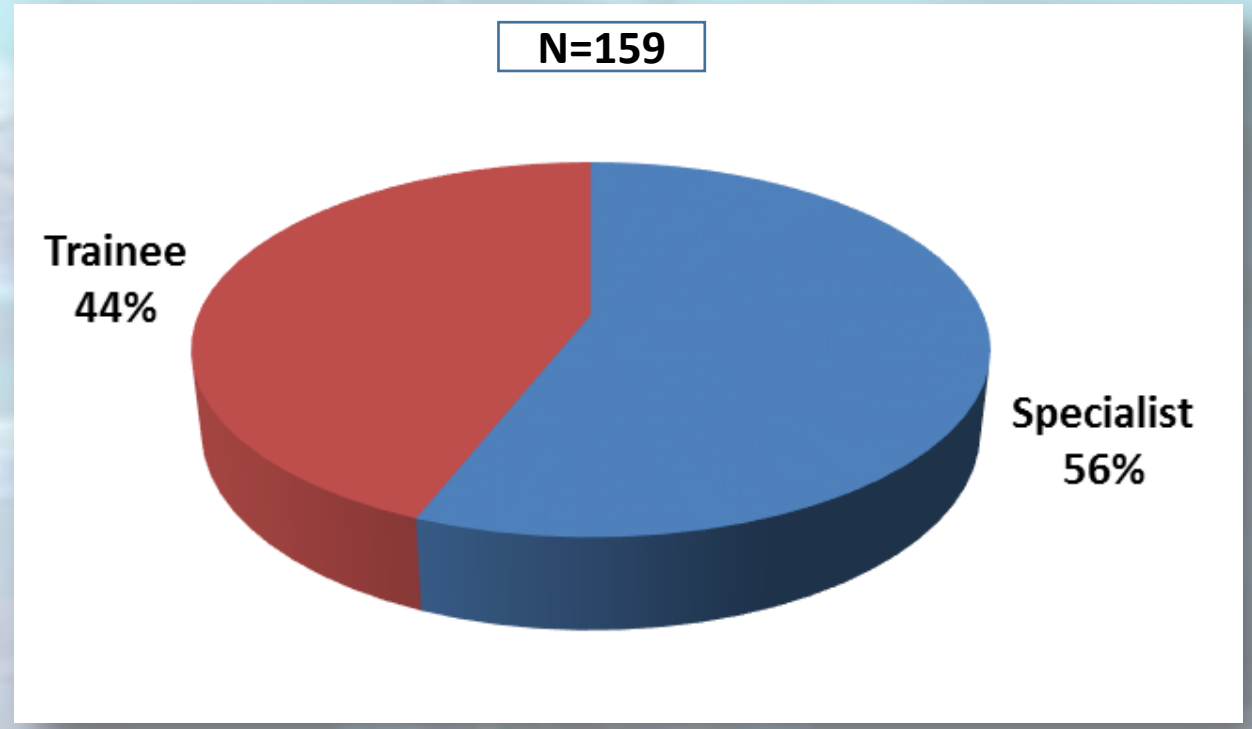
Sex distribution of population



Duration of pre operative stay

Duration	Frequency	Percentage
Less than one day	91	52.2%
1 -3 days	34	21.4%
More than 3 days	34	21.4%
Total	159	100%

Type of operating surgeon

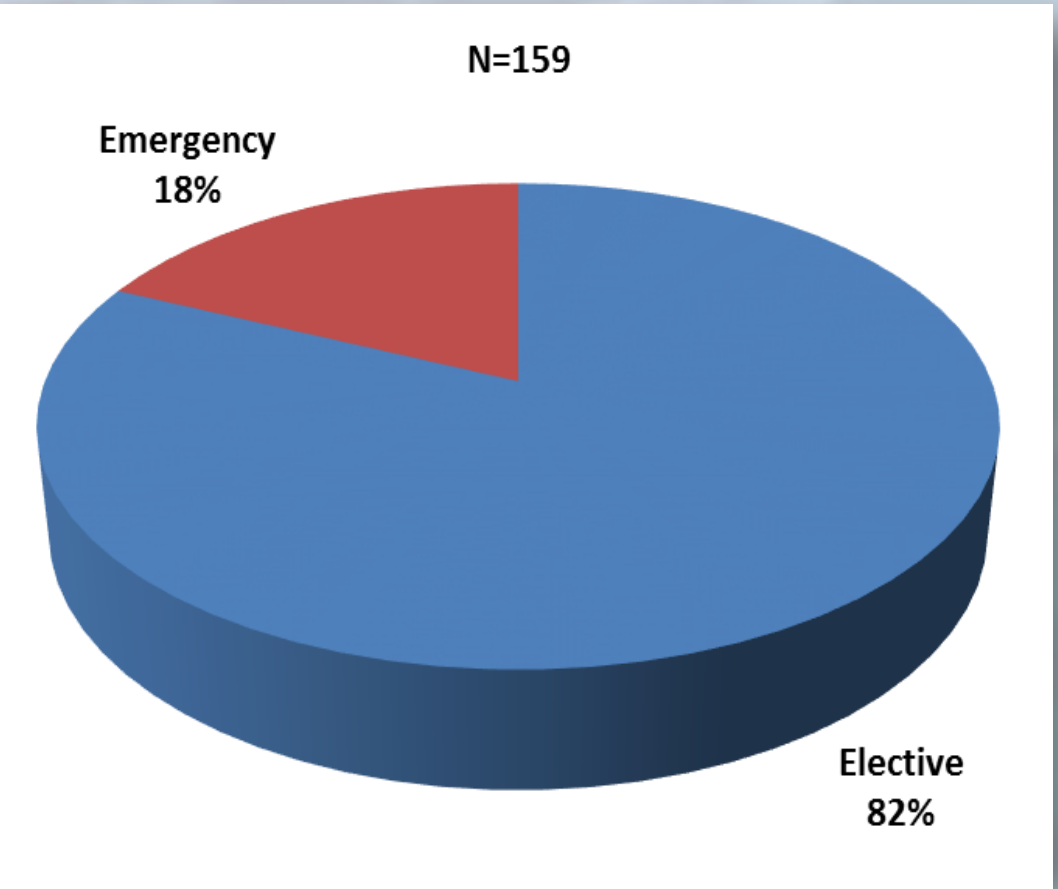


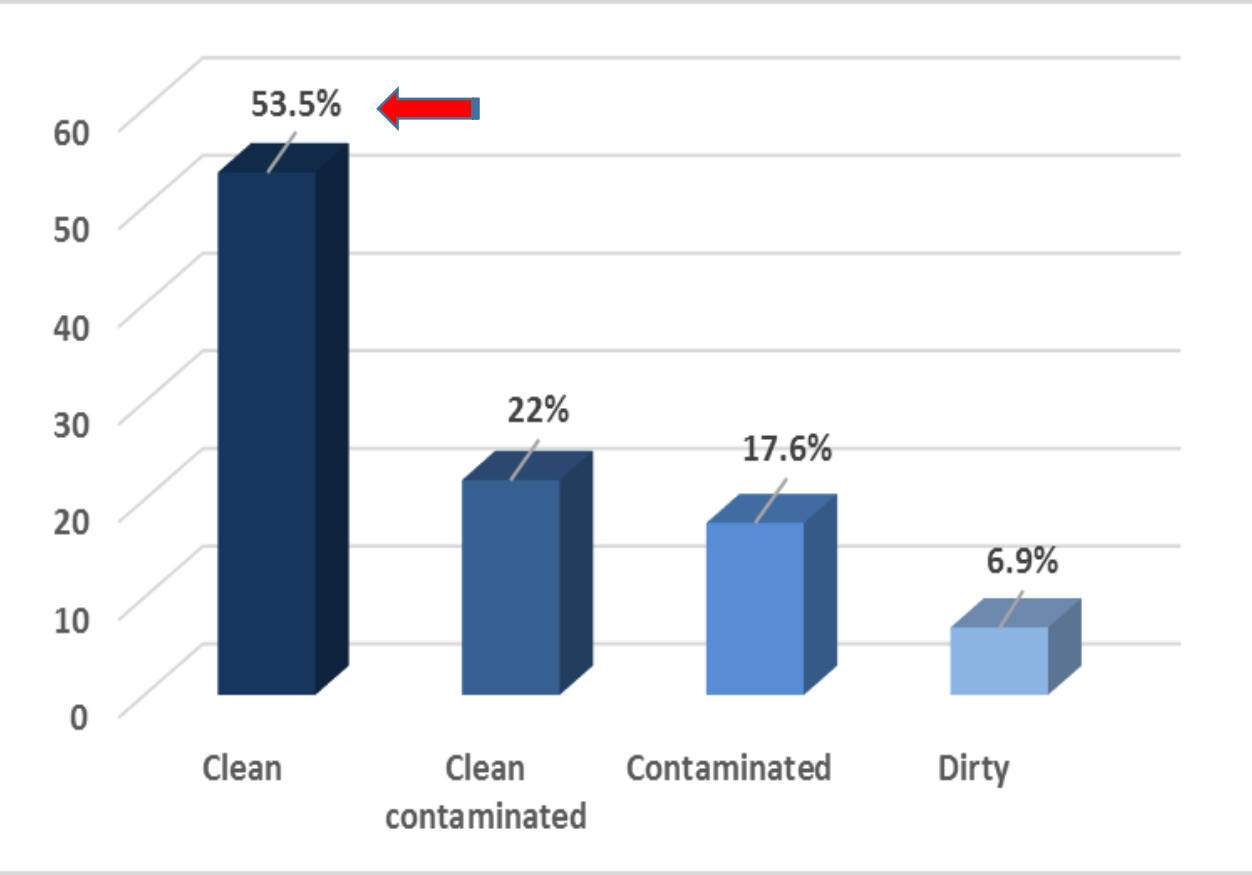
Co morbidities among patients

Having co morbidities	Frequency	Percentage
Yes	13	8.2%
No	146	91.8%
Total	159	100%

ASA classification of operated patients

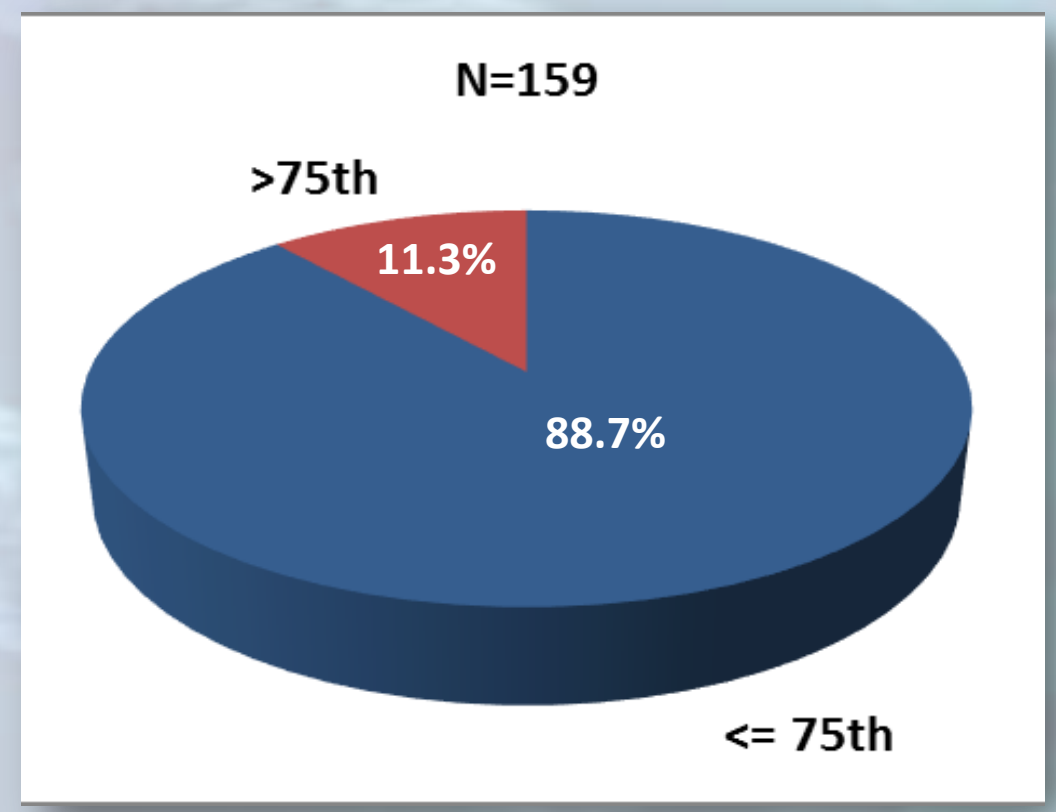
ASA class	Frequency	Percentage
Normal healthy patient	112	70.4%
Patient with mild systemic disease	29	18.2%
Patient with severe systemic disease	17	10.7%
Patient with severe systemic disease that is a constant threat of life	1	0.6%
Total	159	100%

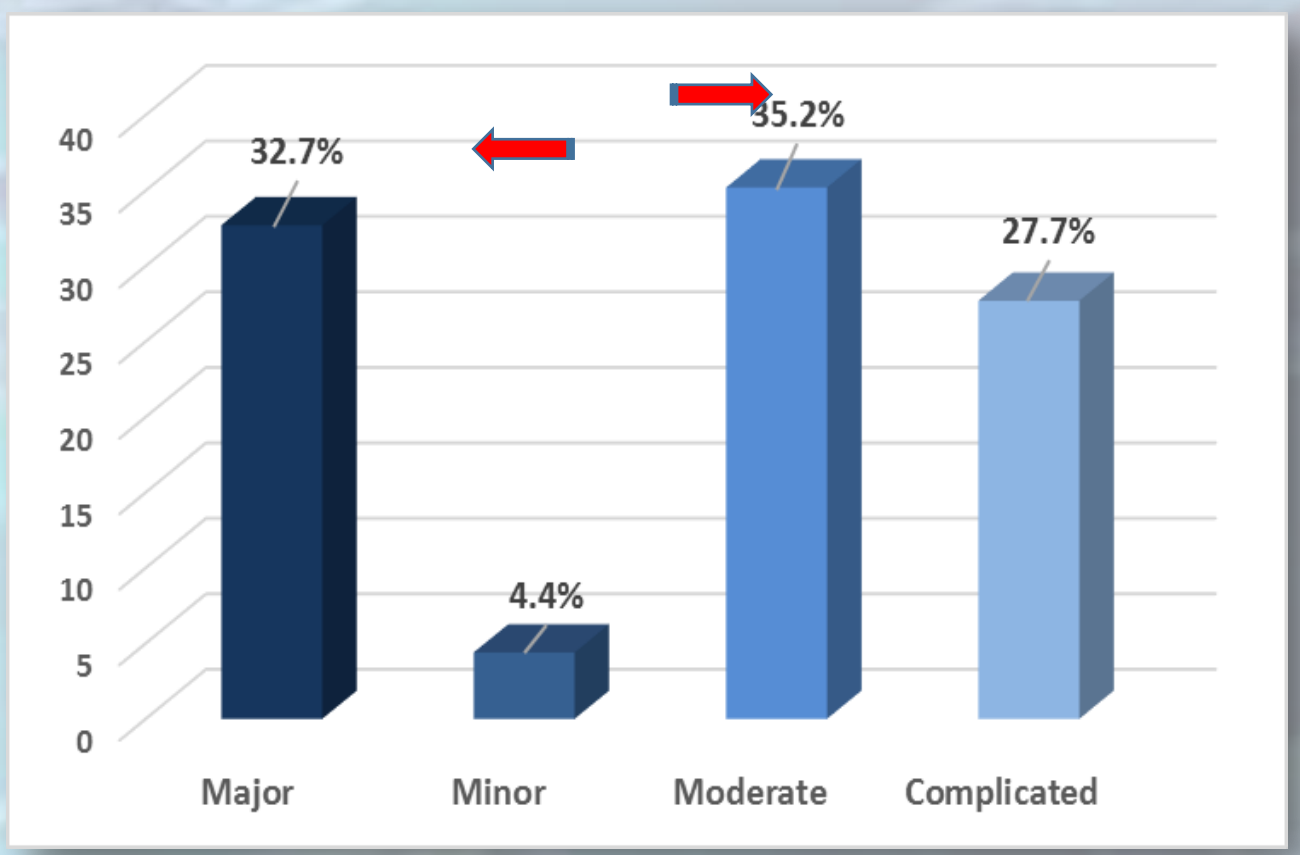




Type of surgical operation

Surgical wound classification

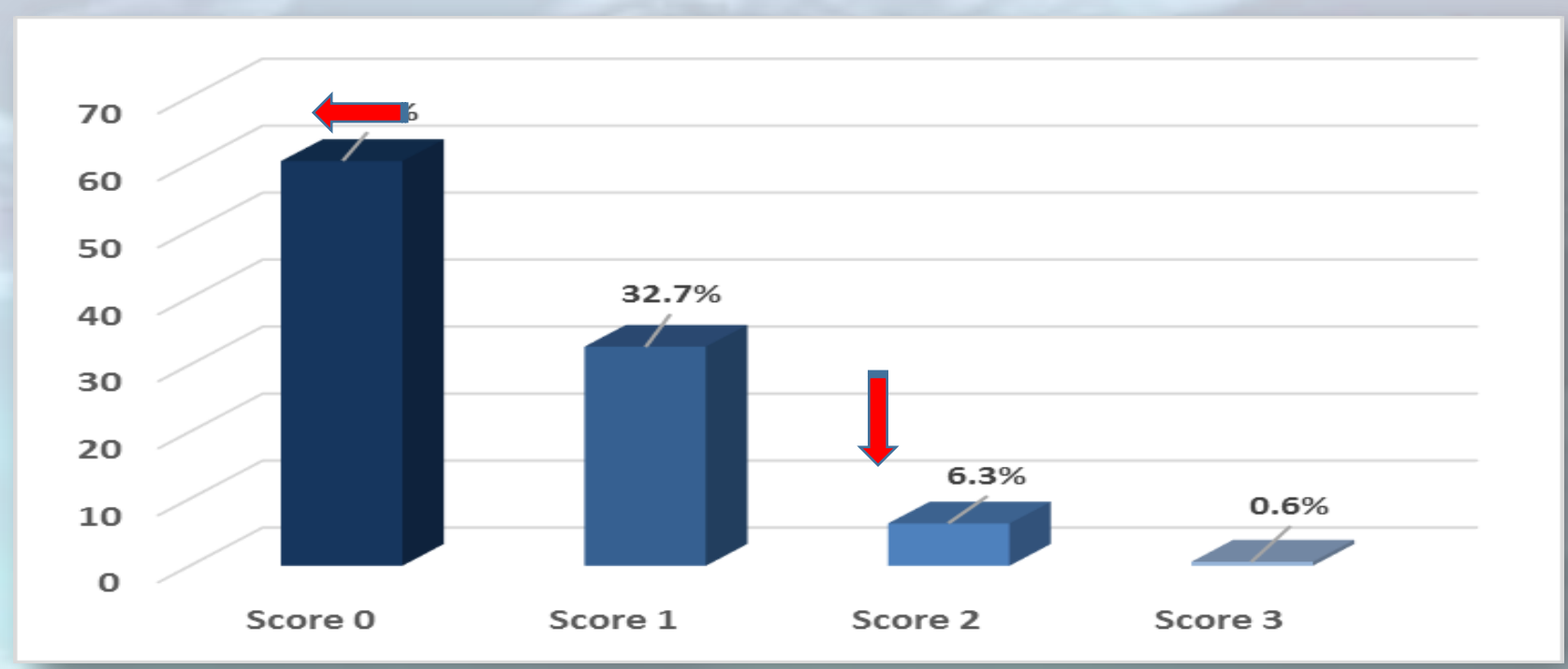




Duration of surgical procedure by percentile

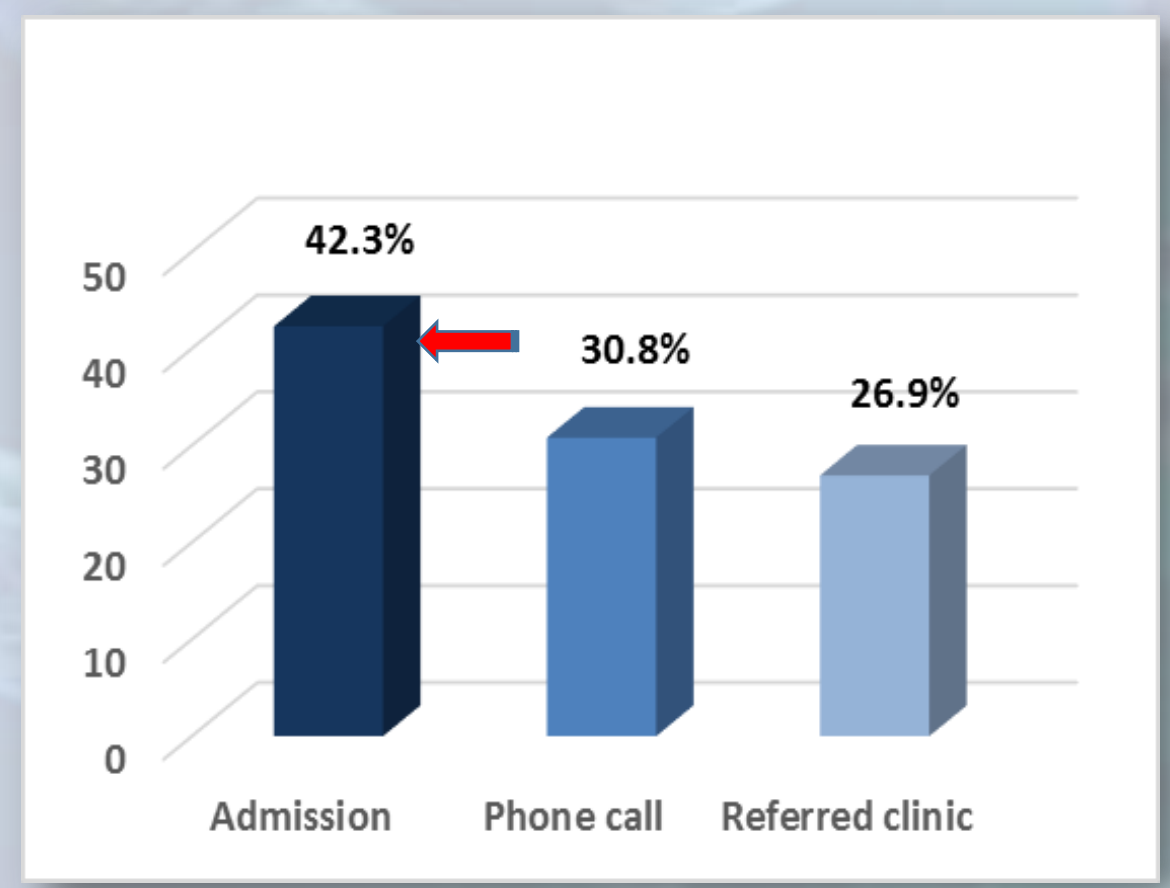
Classification of surgical operation

Calculated NNIS



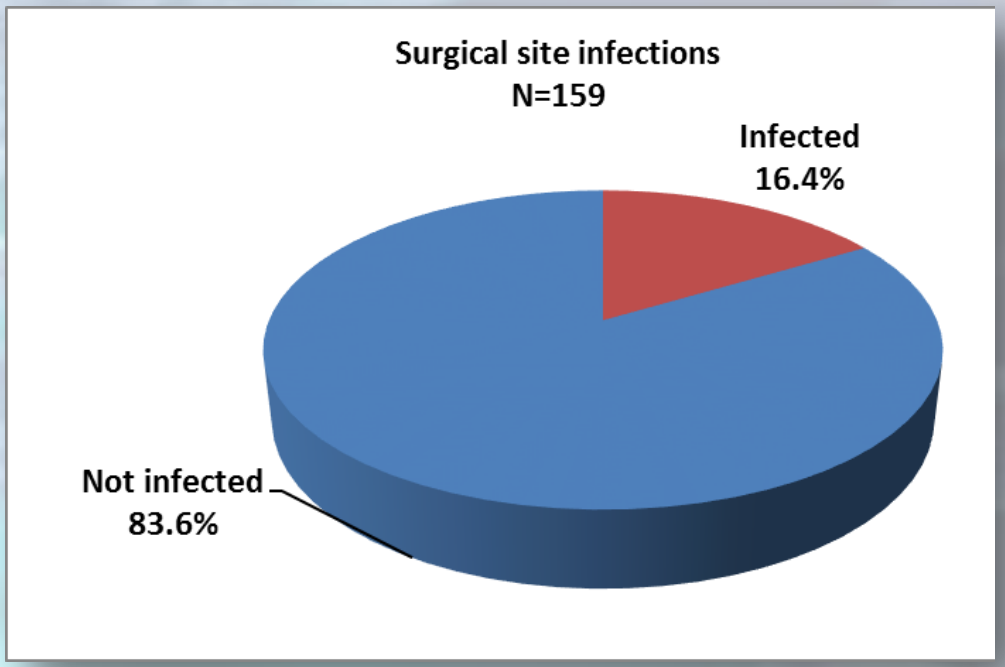
Duration of post operative stay

Duration in days	Frequency	Percentage
Less than 1 day	49	30.8%
1 - < 2 days	31	19.5%
2-5 days	48	30.2%
More than 5 days	31	19.5%
Total	159	100%

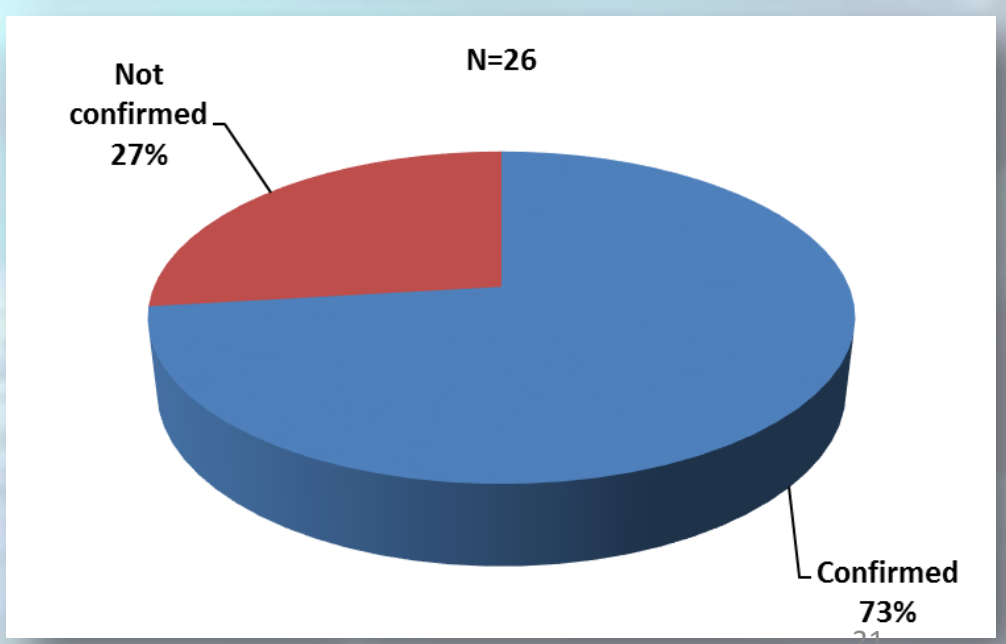


Detection method of SSI

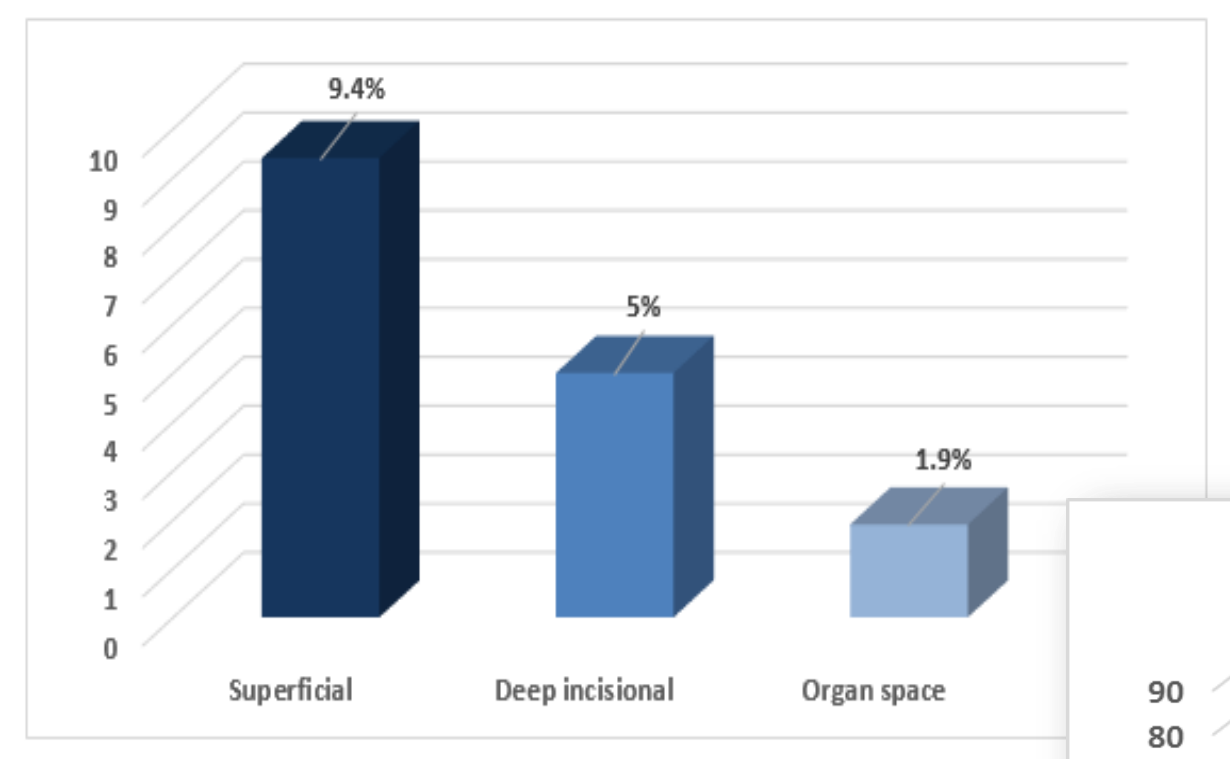
Surgical site infection rate



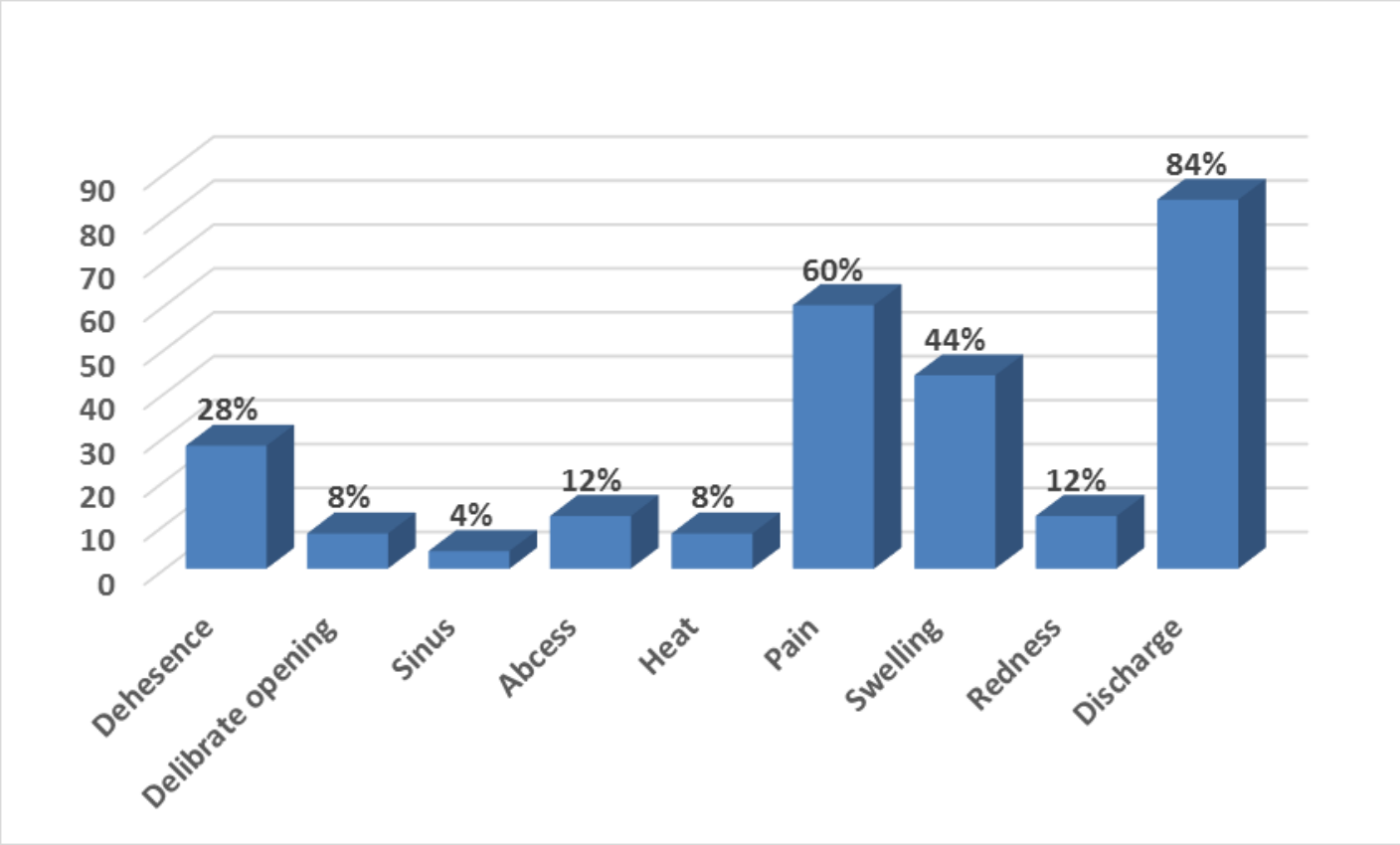
Confirmation of SSI by surgeon

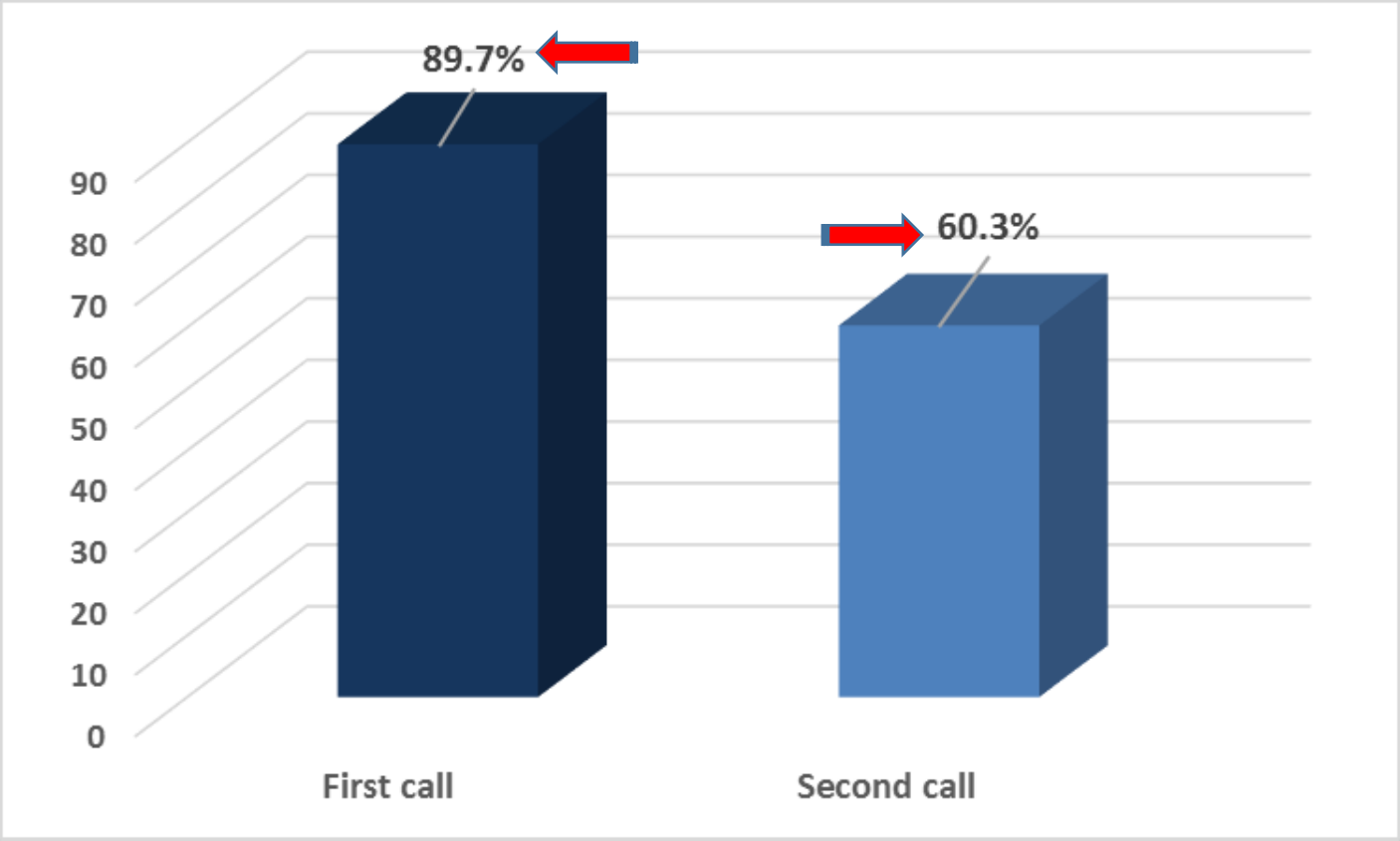


Classification of SSI

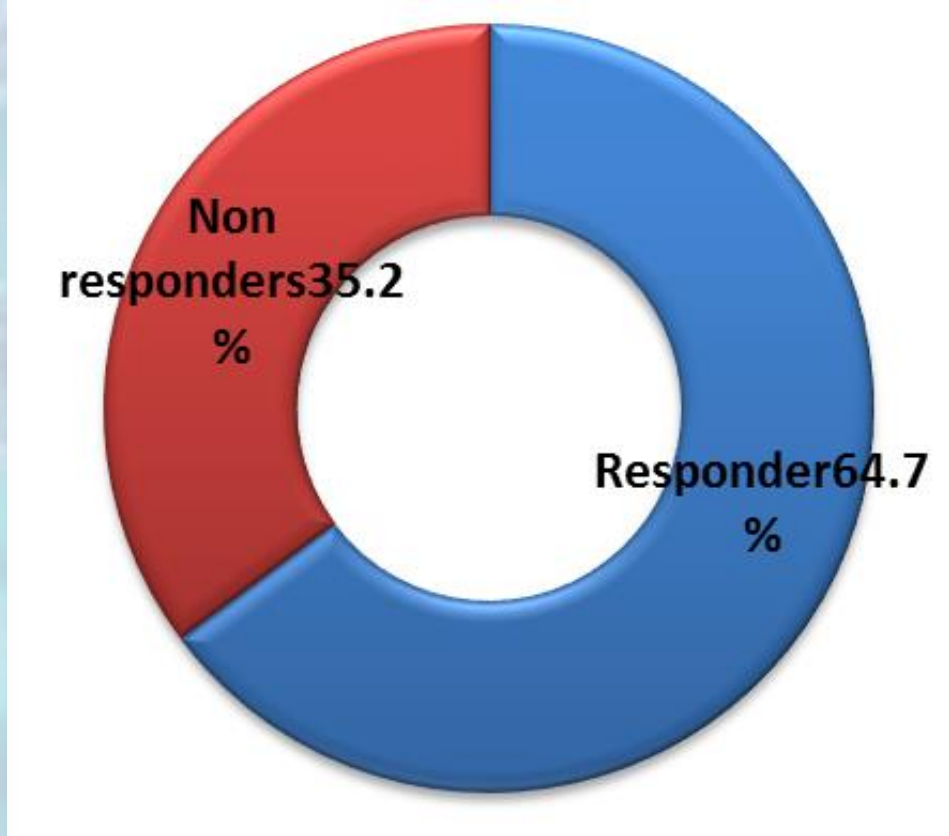


Localized wound findings





Frequency of contact with the patient

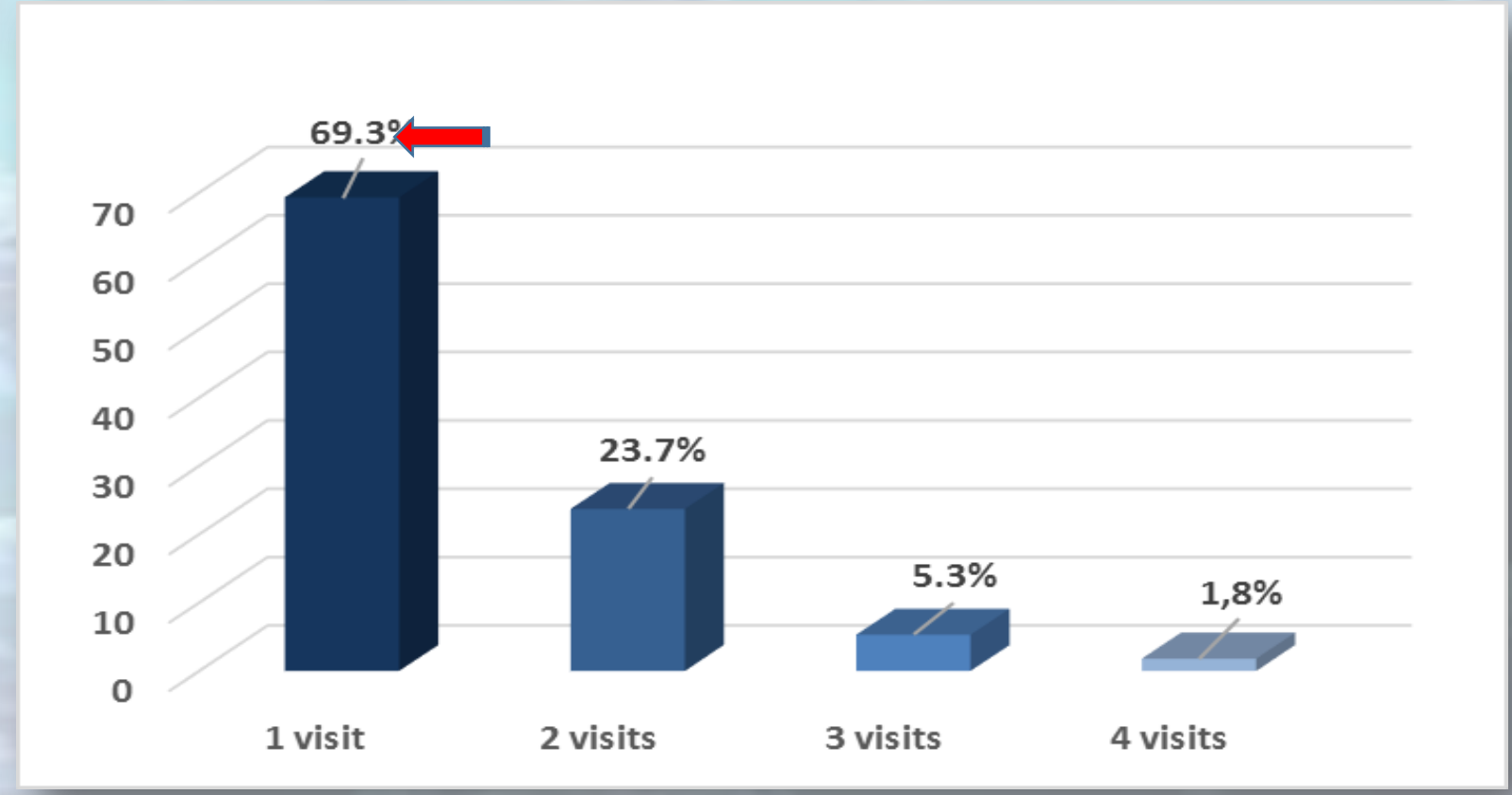


Response to phone calls

Reporting of symptoms by patients on phone calls

Report of symptoms	Frequency	Percentage
Patient having symptoms	8	7.7%
Patient not having symptoms	95	92.2%
Total	103	100%

Frequency of patient visits to referred clinic



Incidence rates

Patient follow up days

- The total number of bed days pre operatively is 386 with an average of 2 days.
- The total number of bed days post operatively is 580 with an average of 4 days.
- The total of bed days for both periods of all patients is 966 bed days with a total average of 3 days of hospital stay.

- The incidence density was calculated as (26/966) x 1000 = 37.2 infection per 1000 bed days.

- Total follow up days = admission follow up days 580 + (30 post discharge follow up days x 159 patients) = 5350 days.

- Incidence density by total follow up days = (26/5350) x 1000 = 4.8 infections per 1000 follow up days.

Association between sex and status of infection (SSI)

P value: 0.001

	Infection status		
Sex	**Infected**	**Not infected**	**Total**
Female	16 (30.2%)	37 (69.8%)	53 (100%)
Male	10 (9.4%)	96 (90.6%)	106 (100%)
Total	26	133	159

Association between Age and status of infection (SSI)

P value: 0.3

	Infection status		
Age group	**Infected**	**Not infected**	**Total**
Less than 1 year	8 (19.0%)	34 (81.0%)	42 (100%)
1– less than 4 years	10 (20.4%)	39 (79.6%)	49 (100%)
3– less than 8 years	2 (6.2%)	30 (93.8%)	32 (100%)
8 years and more	6 (16.7%)	30 (83.3%)	36 (100%)
Total	26	133	159 (100%)

Association between the surgical wound classification and the status of infection (SSI)

P value: 0.01

	Infection status		
Surgical wound class	Infected	Not infected	Total
Clean	8 (9.4%)	77 (90.6%)	85 (100%)
Clean contaminated	7 (20%)	28 (80%)	35 (100%)
Contaminated	10 (35.7%)	18 (64.3%)	28 (100%)
Dirty	1 (9.1%)	10 (90.9%)	11 (100%)
Total	26	133	159

Association between the ASA category and the status of infection (SSI)

P value: 0.006

	Infection status		
ASA classification	Infected	Not infected	Total
Normal healthy patient	12 (10.7%)	100 (89.3%)	112 (100%)
Patient with mild systemic disease	8 (27.6%)	21 (72.4%)	29 (100%)
Patient with sever systemic disease	5 (29.4%)	12 (70.6%)	17 (100%)
Patient with sever systemic that is constant threat to life	1 (100%)	0 (0%)	1 (100%)
Total	23	133	159

Association between the type of operation and the status of infection (SSI)
P value: 0.6

	Infection status		
Type of operation	Infected	Not infected	Total
Elective	22 (16.9%)	108 (83.1%)	130 (100%)
Emergency	4 (13.8%)	25 (86.2%)	29 (100%)
Total	26	133	159

Association between the duration of surgery status of infection (SSI)
P value: 0.1

	Infection status		
Duration of surgery	Infected	Not infected	Total
=< 75th percentile	21 (14.9%)	120 (85.1%)	133 (100%)
>75th percentile	5 (27.8%)	13 (72.2%)	26 (100%)
Total	(100%)	(100%)	

Association between the classification of operation and the status of infection (SSI)
P value: 0.02

	Infection status		
Classification of operation	Infected	Not infected	Total
Minor	0 (0%)	7 (100%)	7 (100%)
Moderate	6 (10.7%)	50 (89.3%)	56 (100%)
Major	15 (28.8%)	37 (71.2%)	52 (100%)
Complicated	5 (11.4%)	39 (88.6%)	44 (100%)
Total	26	133	159

Association between the classifications of surgery with the duration of surgery
P value: 0.5

	75th percentile		
Classification of operation	=<75th Percentile	>75th percentile	Total
Minor	0 (0%)	7 (100%)	7 (100%)
Moderate	48 (85.7%)	8 (14.3%)	56 (100%)
Major	48 (92.3%)	4 (7.7%)	52 (100%)
Complicated	38 (86.4%)	6 (13.6%)	44 (100%)
Total	26	133	159

Association between having comorbidities and the occurrence of infection (SSI)
P value: 0.4

	Infection status		
Patient status	Infected	Not infected	Total
Having co morbidities	3 (23.1%)	10 (76.9%)	13 (100%)
Not having co morbidities	23 (15.8%)	123 (84.2%)	146 (100%)
Total	26 (16.4%)	133 (83.6%)	159 (100%)

Association between the duration of pre operative stay and the status of infection (SSI)
P value: 0.8

	Infection status		
Pre operative stay	Infected	Not infected	Total
=<1day	16 (17.6%)	75 (82.4%)	91 (100%)
2-- 3 days	5 (14.7%)	29 (85.3%)	34 (100%)
>3 days	5 (14.7%)	29 (85.3%)	34 (100%)
Total	26	133	159

Association between the duration of post operative stay and the status of infection (SSI)
P value: 0.000

	Infection status		
Duration in days	Infected	Not infected	Total
Less than 1 day	2 (4.1%)	47 (95.9%)	49 (100%)
1 -2 days	3 (9.7%)	28 (90.3%)	31 (100%)
3-5 days	8 (16.7%)	40 (83.3%)	48 (100%)
More than 5 days	13 (41.9%)	18 (58.1%)	31 (100%)
Total	26 (16.4%)	133 (83.6%)	159 (100%)

Association between the NNIS score and the status of infection (SSI)
P value: 0.02

	Infection status		
NNIS score	Infected	Not infected	Total
0	11 (11.5%)	85 (88.5%)	96 (100%)
1	9 (17.3%)	43 (82.7%)	52 (100%)
2	5 (50%)	5 (50%)	10 (100%)
3	1 (100%)	0 (0%)	1 (100%)
Total	26 (16.4%)	133 (83.6%)	159 (100%)

Significance level of logistic regression test

		B	S.E.	Wald	df	Sig.	Exp(B)
Step 0	Constant	-1.632-	.214	57.943	1	.000	.195

Variables used in logistic regression test

		B	S.E.	Wald	df	Sig.	Exp(B)	95.0% C.I. for EXP(B)	
								Lower	Upper
Step 1[a]	Sex	1.134	.494	5.277	1	.022	3.107	1.181	8.176
	Wound classification	.078	.257	.094	1	.760	1.082	.654	1.788
	ASA category	.559	.318	3.085	1	.079	1.749	.937	3.264
	Class	-.253-	.196	1.664	1	.197	.777	.529	1.140
	Number	.911	.276	10.887	1	.001	2.487	1.448	4.274
	Constant	-6.238-	1.431	19.010	1	.000	.002		

DISCUSSION

- Incidence rate is lower than rates reported by similar studies in Nigeria and Cameron (23.6% & 20%) respectively. (Emmanuel, Ameh, 2009 - Ntsama, Esiene , 2013)

- Patient sex was a significant factor for developing SSI and that is consistent with a study conducted in Nigeria where in contrast, males dominated the study population but was also a significant association with P value: 0.03. (Nowanko,2012)

- The most significant wound class that was associated with infection was the contaminated (35.7%) while in other Nigerian and a Kenyan studies revealed that the highest rate of infection was reported from dirty wound class (60% and 54.7%) respectively. (Dinda, 2014 – Emmanuel, 2009)

- The association of NNIS score and SSI significantly positive association with P value: 0.02 and this is evident in a Turkish study as well. (Namiduru, 2013)

- A systematic review in Brazil have shown that NNIS is a highly recommended tool for prediction of SSI and reduction of SSI rates by 50%. (Ercole, 2009)

CONCLUSION

- The study identified the incidence rate of (13.6%) and an incidence density of (37.2/1000 bed days).
- The study found that active direct surveillance is an applicable method and can easily be used in settings of similar context.

- It was also clear that applying post discharge surveillance has enabled detection of (57.7%) of SSI and has raised the incidence rate from (6.9%) to (16.3%).

- Several risk factors have contributed to the occurrence of SSI (sex, ASA class, NNIS score, duration of post operative stay and the classification of surgery) and NNIS risk index was an easy and useful tool for prediction of SSI risk.

RECOMMENDATIONS

- Establishment of SSI surveillance
- Using NNIS risk index for prediction of SSI and controlling the risk factors.
- Multi disciplinary efforts should be made with re orientation of surgical team on SSI using CDC guidelines to ensure safer surgical techniques

REFERENCES

1- Commission J. The Joint Commission's Implementation Guide for NPSG. 07.05. 01 on Surgical Site Infections: The SSI Change Project. Oakbrook Terrace, IL: The Joint Commission; 2013.

2- Emmanuel A. Ameh PMM, Abdulrasheed A. Nasir, Christopher S. Lukong, Basheer A. Jabo, Mark A. Anumah, and Paul T. Nmadu. Surgical Site Infection in Children: Prospective Analysis of the Burden and Risk Factors in a Sub-Saharan African Setting Surgical Infections. 2009;10(2)(2):105-9.

3- Ercole FF, Starling CEF, Chianca TCM, Carneiro M. Applicability of the national nosocomial infections surveillance system risk index for the prediction of surgical site infections: a review. Brazilian Journal of Infectious Diseases. 2007;11(1):134-41.

4- Keping Cheng JL, Qingfang Kong, Changxian Wang, Nanyuan Ye, Guohua Xia. risk factors for surgical site infection in a teaching hospital: a prospective study of 1138 patientsDove medical press limited. 2015;9:1171 - 7.

5- Namiduru M, KARAOĞLAN İ, Cam R, BOŞNAK V, METE AÖ. Preliminary data from a surveillance study on surgical site infections and assessment of risk factors in a university hospital. Turkish Journal of Medical Sciences. 2013;43(1):156-62.

6- Ntsama Essomba C AJ, Esiene A, Leme Banock L, Abologo Azeme L, Masso Misse P and Essomba A. Prevalence of surgical site infections and evaluation of risk factors after surgery, case of three public hospitals in Cameroon. Journal of Medicine and Medical Sciences. June 2013;4(6):241-6.

7- Nwankwo EO, Ibeh I, Enabulele O. Incidence and risk factors of surgical site infection in a tertiary health institution in Kano, northwestern Nigeria. International Journal of Infection Control. 2012;8(4).

8- Organization WH. Core components for infection prevention and control programmes: Report of the second meeting, Informal Network on Infection Prevention and Control in Health Care, Geneva, Switzerland, 26-27 June 2008. 2009.

9- Organization WH. Report on the burden of endemic health care-associated infection worldwide. 2011.

10- Suzanne M. Pear R, Ph.D, CIC. Patient Risk Factors and Best Practices for Surgical Site Infection Prevention. MANAGING INFECTION CONTROLMarch 2007.

THANK YOU