



SOCIETY FOR CARDIOTHORACIC SURGERY IN GREAT BRITAIN AND IRELAND

**SCTS ANNUAL MEETING 2017** • 12-14 MARCH • BELFAST WATERFRONT

# Negative Pressure Wound Dressing: Does it reduce median sternotomy infection for high risk cardiac cases

Mrs. Rona Suelo Calanao, Mr. Richard Thomson, Mrs. Maxine Read,

Prof. Mahmoud Loubani and Mr. Alexander Cale

Department of Cardiothoracic Surgery

Castle Hill Hospital

# Disclaimer

The group does not have any affiliation to any commercial and/or private company that promotes this product for sales.

# Introduction

- Wound infection following cardiac surgery causes delay in recovery, effect mortality rates and has a significant impact on patient experience and treatment cost.
- Approximately 1,632 cases of readmission due to surgical site infection a year (Public Health England, 2016).
- Additional cost of £7 million per year to the National Health Service (Public Health England, 2016).

- A spike in sternal wound infection in our department prompted a study to identify high risk patients for deep sternal wound infection (Ariyaratnam et al, 2010).



- Risk factors identifies were:

COPD

Obesity (BMI>32)

Diabetes

Age ( > 80 y.o)

## Evidence supporting Prophylactic use of Negative Pressure Wound Dressing (NPWD) on high risk patients

<p><b>Scalise et al 2015</b></p>	<p><b>Systematic Review including 1,003 pts.</b></p>	<p><b>NPWD safe and favourable particularly for high risk patients.</b></p>
<p>Grauhan et al 2014</p>	<p>Prospective study 237 pts. NPWD retrospectively compared 3,508 pts. SD</p>	<p>NPWD had a significantly lower infection rate of 1.3% compared with 3.4% in the SD (P=&lt;0.05).</p>
<p>Grauhan et al 2013</p>	<p>RCT including 150 obese patients</p>	<p>NPWD : 3/75 SWI SD: 12/75 (P=0.0266, CI= 95%)</p>
<p>Colli and Camara (2011)</p>	<p>Single trial (high risk pts.)</p>	<p>NPWT effective at preventing a sternal wound complication at 30-day follow-up</p>



# NPWD compared to standard sterile dressing

## NPWD

- Has a canister to remove wound exudate
- Has interface layer to hasten micro-macro deformation
- Provides mechanical stimulation for wound healing process
- Efficacy supported by multiple trials
- Able to treat anatomically challenging locations and maintain its seal thus, preventing contamination
- Waterproof and small so patient can mobilise freely or have a shower with it.

## Standard dressing

- Has absorbent padding for exudate
- No interface layer
- No mechanical stimulation
- Lack of wound care studies supporting efficacy
- Can easily come off when applied to challenging areas exposing wound to contaminants
- Waterproof standard dressing can leak or come off during movement.

# Objective

- To examine the impact of the use of Negative Pressure Wound Dressing on the incidence of wound infections in the Department of Cardiothoracic Surgery at Castle Hill Hospital



# Methodology

- Patients groups:
  - Group 1 - 2009-2012, standard sterile dressing
  - Group 2 - 2013-2016 when NPWD was introduced.
- Intervention in Group 2:
  - Less than 2 risk factors, standard absorbent sterile dressing
  - 2 or more risk factors, NPWD

- NPWD was kept for 5 days unless there is a leak in the seal, which was repaired by adding another adhesive layer but not exposing the wound.
- All wounds assessed after 5 days.

# Methodology

- All variables are compared using mean +/- standard deviation.
- The Fishers exact test, two- tailed was used to calculate the p-value for all categorical data
- An unpaired t-test, two- tailed was used to calculate the p-value for all continuous data

# Results

	Group 1	Group 2	P value
<b>Total number of patients</b>	<b>927</b>	<b>932</b>	
Diabetes	236	232	0.836
COPD	166	168	1.000
BM> 32	207	209	1.00
Age (Average)	67.801	67.090	0.1510, CI= -0.26 to 1.67
<b>Other factors</b>			
Euro score (Average)	5.159	5.718	0.0003, CI= -0.89 to 0.27
Log Euro score (Average)	6.802	8.126	0.00015, CI= -2.4654 to -0.5832

# Results

	Group 1	Group 2	P value
<b>Op Priority</b>			
Urgent	217	266	0.0587
Emergency	14	29	0.0300
Elective	671	610	0.1678
Expedite	25	28	0.7810
<b>Type of Operation</b>			
CABG	623	607	0.6595
CABG + Valve	65	88	0.0923
Valve	130	123	0.6878
Other cardiac procedure	109	115	0.7773

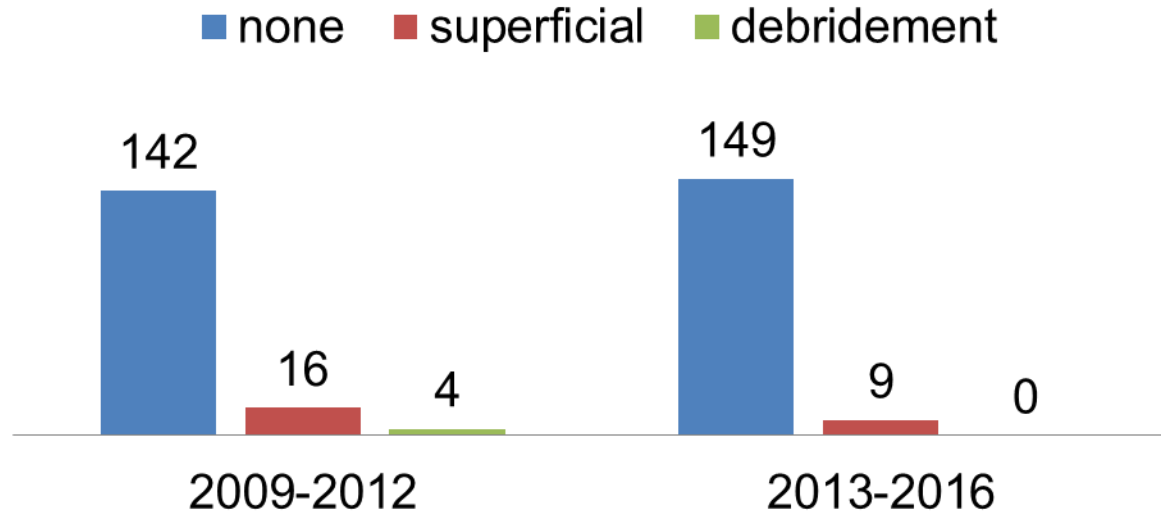
# Results

	Group 1			Group 2			P values
		Length of post-operative stay (days) (Average)	Long/short term mortality (Status on Discharge)		Length of post-operative stay (days) (Average)	Long/short term mortality (Status on Discharge)	
<b>Total number of patients</b>	<b>927</b>			<b>932</b>			
<b>Patients with sternal wound Infection (SWI)</b>	<b>81</b> <b>8.7 %</b>			<b>41</b> <b>4.4%</b>			<b>0.0005</b>
Superficial (SWI)	63 pts.	19.3 days	Dead= 0 Alive= 63	36 pts.	21.2 days	Dead= 0 Alive= 36	0.0096
Requires Debridement (SWI)	17 pts.	66.7 days	Dead= 1 Alive= 16	5 pts.	54 days	Dead= 0 Alive= 5	0.0102
Sternal Resuturing (SWI)	8 pts.	55 days	Dead= 1 Alive= 7	3 pts.	53.8 days	Dead= 0 Alive= 3	0.2252

# Group 2 Results

	Non NPWD < 2 risk factors	NPWD > 2 risk factors	P value
Total number of patients	745	158	
Total number of patients with infection	32	9	0.5286
Percentage	4.29%	5.69%	

# Infection rates in patients with $\geq 2$ risk factors

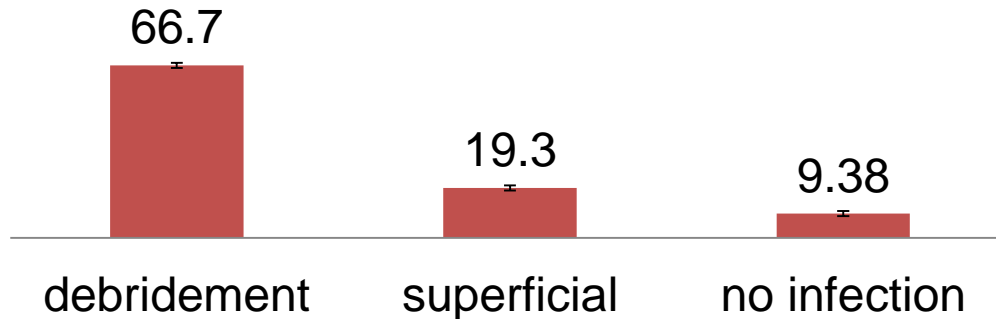


Since the introduction of NPWD in high risk patients we have seen a reduction in wound infections in the high risk patients, there have been no debridement's required

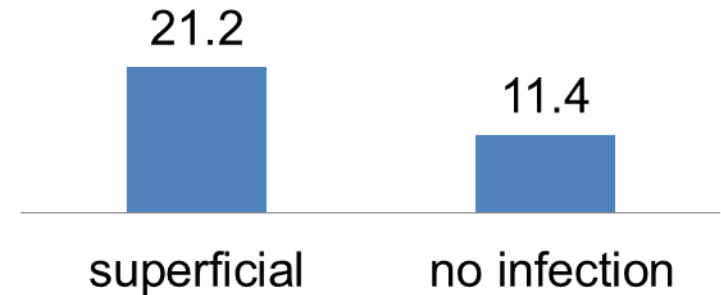


# LOS

length of stay high risk patients group 1 (2009-2012)



length of stay high risk patients group 2 (2013-2016)



Mean LOS in both the superficial and the non infected patients was higher in the NPWD group, however if a patient required debridement they stayed significantly longer

# Comparing costs

	Debridement	Total bed days	NPWD costs	Total cost
2009-2012 LOS (mean)	4 66days	£250 per day (conservative estimate) 218.4 extra bed days		£54,600
2013-2016 LOS (mean)	0 11.4days	0	45,346 (for the 158 patients)	£45,346
				Saving by using NPWD = £9254

# Conclusion

- NPWD reduces the incidence of sternal wound infection in high risk patients.
- Its cheaper to use NPWD in high risk patients
- Patients stay longer with NPWD
- There is a need for level 1 evidence in this area.
- Our model for prediction of risk of sternal wound infection requires validation.

## References:

- Atkins, Z. B. and Wolfe, W. G. (2012) 'Sternal Wound Complications Following Cardiac Surgery', in Narin, C. (ed.) *Special Topics in Cardiac Surgery*. InTech, pp. 283–308.
- Arityaratnam, P., Bland, M. and Lounabi, M. (2010) Risk factors and Mortality associated with deep sternal wound infections following coronary bypass surgery with or without concomitant procedures in a UK population: a basis for a new risk model? *Interactive Cardiovascular and Thoracic Surgery*. Available at: <http://icvts.ctsnetjournals.org/cgi/content/full/11/5/543> (Accessed: 13 January 2015)
- Colli, Andrea (2011) First experience with a new negative pressure incision management system on surgical incisions after cardiac surgery in high risk patients. *Journal of Cardiothoracic Surgery*. Available at: <http://www.cardiothoracicsurgery.org/contents/6/1/160>. (Accessed: 22 January 2015).
- Dumville, J., Gray, T., Walter, C., Sharp, C. and Page, T. (2014) Dressings for the prevention of surgical site infection. Available at: <http://onlinelibrary.wiley.com/doi/10.1002/14651858.CD003091.pub3/full>. (Accessed: 09 February 2015).
- Grauhan, O., Navasardyan, A., Tutkun, B. and Hennig, F. (2014) 'Effect of surgical incision management on wound infection in a poststernotomy patient population'. *International Wound Journal*, 11(1), pp. 6-9.
- Gerrish, K. and Lacey, A. (2006) *The research process in nursing*. 5th edn. Oxford: Blackwell Publishing.
- Kilpadi, DV., Lessing, C. and Derrick, K. (2014) 'Healed porcine incisions previously treated with a surgical incision management system: mechanical, histomorphometric, and gene expression properties'. *Aesthetic Plastic Surgery*, 38(4), pp. 767-778.
- National Institute for Health and Care Excellence (2008) *NICE Guidelines on Surgical Site Infection: Prevention and treatment of surgical site infection*. Available at: <http://www.nice.org.uk/guidance/cg74/chapter/1-guidance>. (Accessed: 03 January 2015).
- Public Health England (2016) *Surveillance of Surgical Site infections in NHS Hospitals in England 2015-2016*. Available at: <http://www.phe.gov.uk>. (Accessed: 11 January 2017).
- Office of National Statistics (2015) *Mortality in the United Kingdom 1983-2013*. Available at: <https://www.ons.gov.uk> . (Accessed: 20 December 2016).

# Risk factors and mortality associated with deep sternal wound infections following coronary bypass surgery with or without concomitant procedures in a UK population: a basis for a new risk model? □

Priyadharshanan Ariyaratnam, Martin Bland, Mahmoud Loubani, Castle Hill Hospital, Cottingham, East Yorkshire HU16 5JQ, UK

Interact CardioVasc Thorac Surg (2010) 11 (5): 543-546.

DOI:<https://doi.org/10.1510/icvts.2010.237883>

Published: 01 November 2010

## Abstract

Deep sternal wound infection (DSWI) is a rare but serious complication following coronary artery bypass surgery. Our study investigates the risk factors and mortality associated with DSWI with other risk models for DSWI. Data was collected prospectively on 7602 patients undergoing coronary artery bypass grafting±concomitant surgery between April 1999 and September 2009 including DSWI. All 13 Society for Thoracic Surgeons (STS) risk scoring variables were assessed using logistic regression in relation to developing DSWI. The STS risk scores were evaluated using the area under the receiver operating curve. A total of 44 (0.59%) patients developed DSWI. These patients had a higher mortality (9.1%) than patients without DSWI (2.6%) ( $P=0.03$ ). The mean preoperative and combined STS scores were significantly higher in the DSWI patient group compared to the non-DSWI group ( $9.46\pm 4.30$  and  $8.76\pm 3.86$  vs.  $7.07\pm 4.25$  and  $6.51\pm 4.11$ ,  $P=0.0003$  and  $P=0.0005$ , respectively). Logistic regression identified age [odds ratio (OR)=1.055], body mass index (OR=1.076), diabetes (OR=2.00) and chronic lung disease (OR=2.47) as the significant independent determinants of DSWI from the variables considered. Mortality rates and mean STS scores are higher in patients requiring re-opening for DSWI. Not all the STS risk factors were predictors of DSWI in our population.