

Background

Surgical site infections are common yet preventable complications following surgical procedures. A substantial body of literature indicates that patients with poor long-term or perioperative glycemic control are more susceptible to postoperative infections. However, optimal HbA1c and glucose targets for neuromodulation pain procedures remain unclear. This quality improvement study aims to examine how diabetes mellitus, HbA1c, perioperative glucose levels, and related variables influence the development of postoperative infections in patients undergoing neuromodulation procedures. Based on our previous experience with postoperative infections in patients with poor perioperative glycemic control, we aim to determine whether diabetic patients with lower hemoglobin A1c levels show reduced postoperative complications and improved patient outcomes.

Methods

This retrospective study, approved by the institutional QIAB with a waiver of consent, analyzed surgical cases from the Department of Pain Medicine between October 2019 to July 2024. Data gathered from the electronic medical record included trials, implants, revisions, and explants related to spinal cord stimulators (SCS), intrathecal drug delivery systems (IDDS), dorsal root ganglion stimulation (DRG-S), intrathecal implants, vertebral augmentation, and peripheral nerve stimulation (PNS). Patient demographics, clinical characteristics, and surgical outcomes were summarized through descriptive statistics. Procedure-related variables (e.g., diabetic status, HbA1C, perioperative glucose, surgery duration) were summarized for each procedure. Continuous variables (e.g., age) were summarized using means, medians, standard deviations, and ranges. Categorical variables (e.g., gender) were summarized using frequencies and proportions. Generalized linear mixed model was used to associate surgical site infections with the demographic and clinical factors.



Figure 1: Intrathecal pump



Figure 2: Spinal cord stimulator

Results

- 298 surgical cases analyzed
- 9 surgical infections occurred (mean HbA1c: 7, mean glucose: 143 mg/dl)
- Postoperative infection rate: 3%
- Significant association between postoperative infections and HbA1c (p-value = 0.0115)
 - 1-unit increase in HbA1c → 86.41% increase in odds of postop infection (OR: 1.8641, 95% CI: 1.1497, 3.0225)
- Significant association between postoperative infections and diabetes (p-value = 0.0111)
 - Diabetic patients had 6 times higher odds of postop infection (OR: 6.2286, 95% CI: 1.5179, 25.5588)

Variable		No (N=288)	Yes (N=9)	Total (N=297)	OR	Low	Upper	P-value
Sex								
	F (ref)	134 (46.5%)	5 (55.6%)	139 (46.8%)				
	M	154 (53.5%)	4 (44.4%)	158 (53.2%)	0.7	0.2	2.6	0.5948
BMI								
	Mean (SD)	29.6 (7.3)	27 (10.2)	29.5 (7.4)	0.95	0.9	1.1	0.2901
	Median	28.4	26	28				
	Range	16 - 52	14 - 50	14 - 52				
diabetic								
	No (ref)	218 (75.7%)	3 (33.3%)	221 (74.4%)				
	Yes	70 (24.3%)	6 (66.7%)	76 (25.6%)	6.2	1.5	25.6	0.0111
HbA1C								
	N-Miss	131	0	131	1.9	1.2	3	0.0115
	Mean (SD)	5.9 (1.1)	7 (1.5)	6 (1.1)				
	Median	5.8	7.3	5.8				
	Range	4 - 10.6	5.3 - 8.8	4 - 10.6				
insulin								
	No (ref)	263 (91.3%)	6 (66.7%)	269 (90.6%)				
	Yes	25 (8.7%)	3 (33.3%)	28 (9.4%)	5.3	1.2	22.3	0.0244
Periop Glucose								
	N-Miss	135	1	136	1	1	1.02	0.0643
	Mean (SD)	113.6 (37.1)	143.4 (84.0)	115.1 (40.7)				
	Median	102	110	102				

Table 1: Comparison of postoperative infections between variables

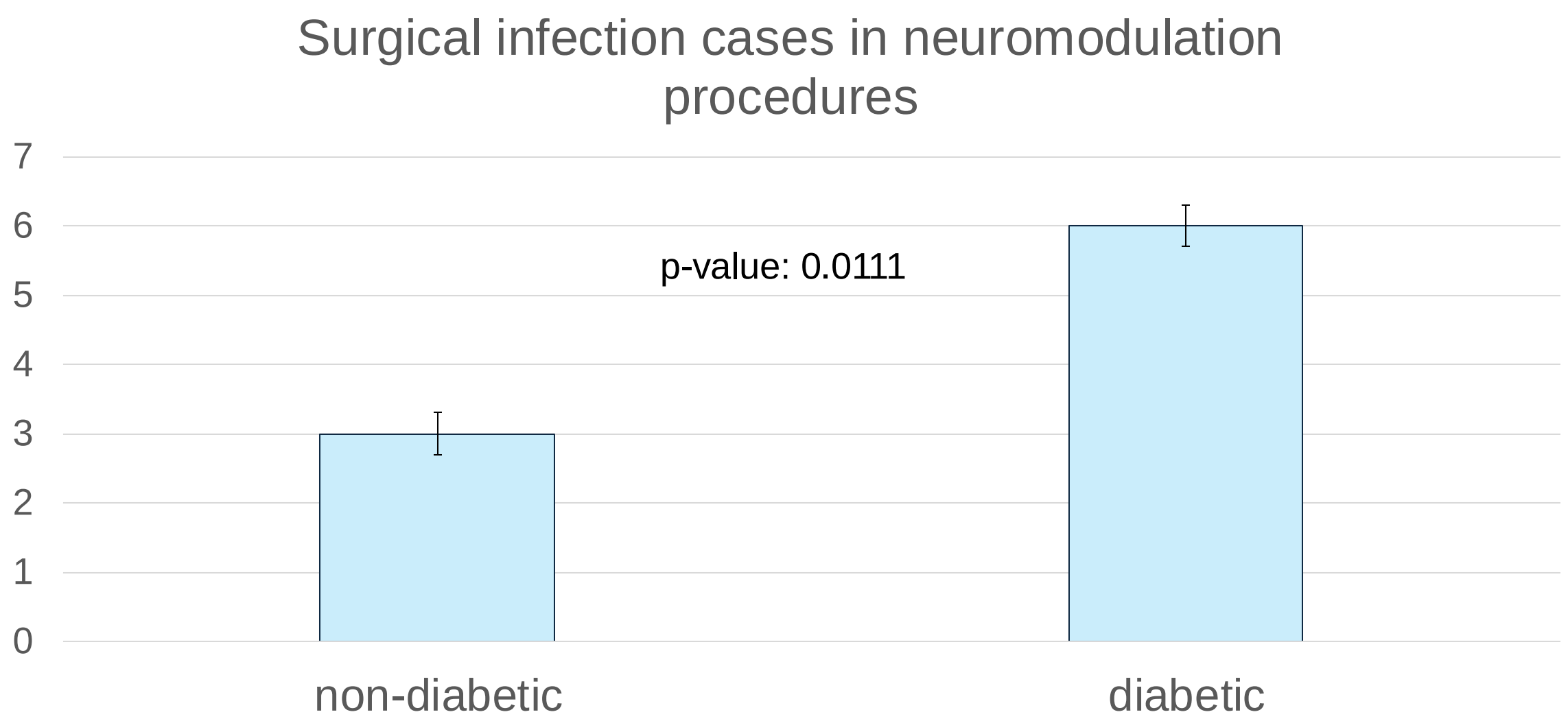


Figure 1: Surgical infection cases in neuromodulation pain procedures

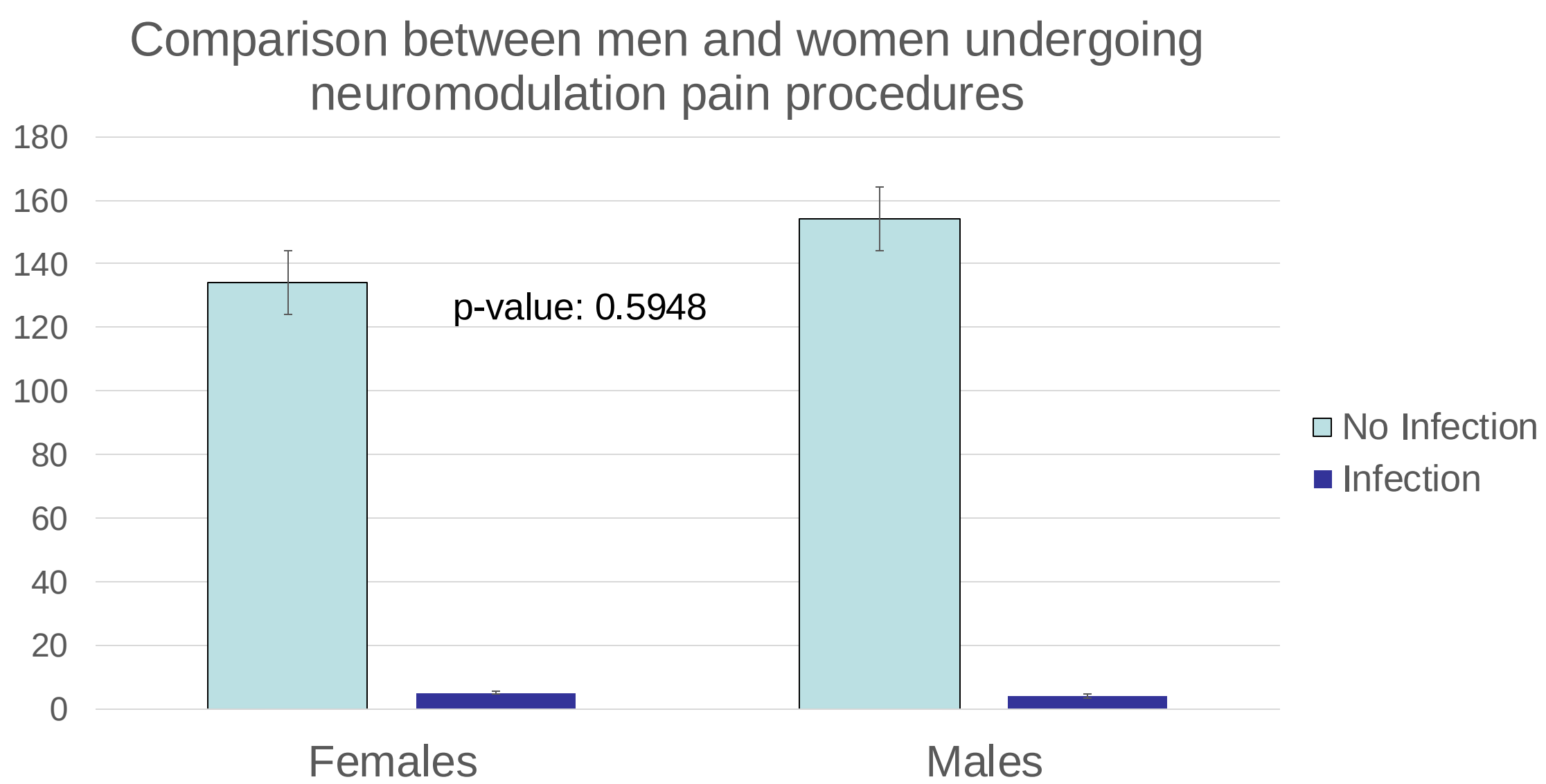


Figure 2: Men and women comparison undergoing neuromodulation pain procedures

Discussion/Conclusion

Surgical site infections were predominantly observed in patients with diabetes mellitus, who commonly had elevated hemoglobin A1c levels and glucose levels. A significant association between postoperative infections and HbA1c was found (p=0.0115), with each unit increase resulting in 86.41% increase in odds of postoperative infection. Similarly, diabetic patients had a significantly higher risk of operative infections (p=0.0111), with odds 6 times greater compared to non-diabetic patients. Diabetes mellitus and elevated HbA1c are significant risk factors for increased infection rates in neuromodulation pain procedures. The overall postoperative infection rate was 3%, similar to the 2.45% rate in patients receiving spinal cord stimulators.² These findings highlight the need to proactively prevent infections by avoiding high-risk procedures in diabetic patients, thereby enhancing overall patient outcomes. The next step is to identify and propose optimal glycemic control targets for neuromodulation procedures.

References

