Comparison of implant surgery and readmissions costs for DBS and VNS

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INTRODUCTION

Epilepsy affects all ages and is a common, disabling serious neurological disease often associated with comorbidities[1]. The disease presents a heavy clinical, economic, and societal burden with a continued treatment gap that deserves attention of healthcare decision makers[2]. A considerable number of patients do not respond satisfactorily to drug treatment and/or are ineligible for respective epilepsy surgery. Implant surgery might offer a therapeutic option for those patients. Deep Brain Stimulation (DBS) and Vagus Nerve Stimulation (VNS) are neuromodulation devices that intervene directly in neural circuits and present interesting results in seizure control [3,4]. Besides the therapeutic impact of these treatments for epilepsy, comparative cost scenarios for a Brazilian supplemental health data sample were assessed with the objective of assessing the cost of DBS and VNS procedures.

METHODS SECTION

The supplemental health data on DBS and VNS hospitalizations for the period Jan/2009 and Sep/2021 were collected through the Managerial Matrix software (NAGIS). The type of surgery was determined by the procedure performed, because the ICD field is not mandatory. Assumptions made in the assessment:

- Hospitalizations with a gap of less than 4 days were combined.
- Hospitalization with more than one device billing - probably correspond only to one device in the same surgery (installment payment of the same device) - was normalized to one device.
- The VNS was classified indirectly when the hospitalization did not include DBS.

The surgery cost was considered the sum of all procedures done during a hospitalization, these procedures included professional costs. The cost of the surgery room and recovery room was determined by the sum of the procedural costs. Due to the lack of available information regarding the surgery room hours, the cost of the procedure related to the surgery room was utilized as a proxy. In this way, more expensive procedures imply more time and/or complexity. For the study, only readmissions related to complications that occurred within six months of the index surgery were considered (complications were classified according to the procedures performed).

RESULTS

Of the total number of surgeries performed (n=812), 43.6% (354) were associated with DBS and 56.4% (458) associated with VNS.

Table 1. Metrics and costs (in BRL) for DBS and VNS surgeries. Each value is the total severity divided frequency by type of surgery type.

Metrics	VNS	DBS	Difference
Hospitalization length of stay (days)	4,6	17,6	-285%
Average surgery cost (BRL)	42.005,32	127.855,54	-204%
Average surgery room costs (BRL)	888,43	2.094,92	-136%

All comparative data presented P-value < .0005

When compared to the DBS, VNS had fewer days of hospitalization (Table 1) resulting in lower average surgery cost. Additionally, the room costs of surgeries of VNS had a 136% lower budget impact than those related to DBS.

Although VNS presented a higher device cost, it showed a lower total cost when assessed across index hospitalization (Figure 1). Furthermore, VNS presented significantly fewer readmission events (DBS: 20.1%, n=71; VNS: 0.9%, n=4, Figure 2. A). The total cost impact of DBS readmissions represented 113 times the absolute cost of VNS readmissions and VNS readmissions were, on average, $12,619.00 (BRL) cheaper than the DBS.

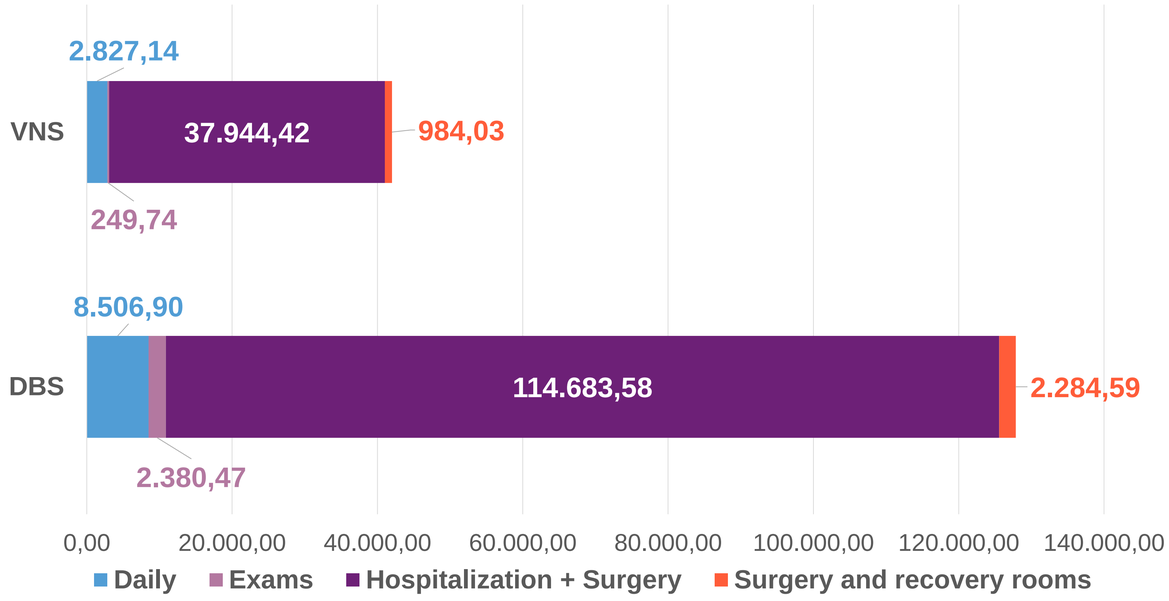

Figure 1. The average detailed costs (in BRL) of DBS and VNS.

Furthermore, the Intensive Care Unit (ICU) was used in 53.4% of DBS hospitalizations, while for VNS, ICU was used in only 19.2% (Figure 2. B) of cases. The average cost of ICU for DBS was 49% higher than that of VNS, which might indicate more complexity on DBS complications. In agreement with our results, a different methodology study using administrative healthcare data from the USA showed similar results regarding lower healthcare costs and a less invasive profile of VNS[5].

All comparative data presented P-value < .0005

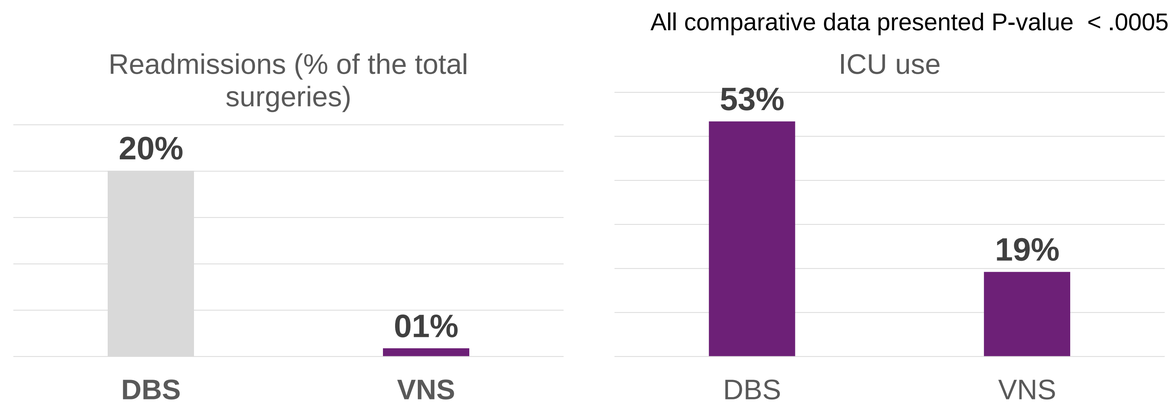

Figure 2. Percentage-readmissions up to 120 days (**A**) and the use of ICU in DBS and VNS hospitalizations. (**B**)

CONCLUSION

According to our findings, patients utilizing DBS had higher expenses than those using VNS based on surgical procedure and readmissions six months post index surgery and probably these costs are due to DBS being a more invasive technique. Therefore, because the VNS is less invasive, it enables the reduction of hospitalizations and reduction of costs in drug-resistant epilepsy treatment. Thus, VNS may be an alternative for payers to consider when evaluating short-term costs, even with a higher device cost compared to DBS.

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