Length of Stay After Blood Volume Analysis in Hospitalized Heart Failure

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BACKGROUND

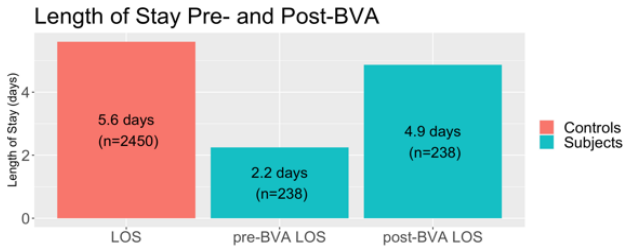
Analysis was performed for 245 consecutive HF admissions to a community hospital (Sept 2007–Apr 2014, age 78± 10 yrs, HFrEF 50%, Stage 4 CKD 30%). Total blood volume (TBV), red blood cell volume (RBCV) and Plasma Volume (PV) were measured by a computer-based I-131 labeled albumin indicator-dilution technique [Daxor BVA-100]. A propensity matched control study of outcomes from this population was previously published, demonstrating significant improvement in 30-day readmission and mortality rates for BVA-guided subjects vs. controls.[1]

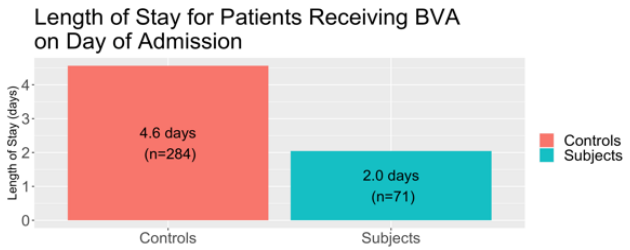
METHODS

The date of Blood Volume Analysis (BVA) was compared to hospital admission and discharge dates, allowing the calculation of pre- and post-BVA Length of Stay (LOS) for all patients. Seven patients were excluded from the analysis (leaving 238 cases) because the blood volume BVA used to guide treatment was performed one or more days prior to the date of admission. An additional subset analysis was conducted on the 71 cases where BVA was performed on the day of admission. As the population characteristics (age, comorbidities, etc.) of this subset were no longer ideally matched to the those of the full control population (n=2450), a second propensity-matched control selection was made from the existing controls, yielding a 4:1 subset of 284 controls which showed an excellent match to the population characteristics of the 71 subjects with day-zero BVA measurements. The upper figure shows the breakdown of pre- and post-BVA LOS for the full 238 cases. The lower figure shows the comparison of LOS for the 71 subjects who received a BVA measurement on the day of admission, versus the propensity matched controls (n=284) for these subjects. Note that the LOS for the smaller controls subset is slightly less than that of the larger controls group; this is consistent with the different population characteristics of the subset (somewhat younger, with fewer comorbidities).

RESULTS

The post-BVA LOS was 4.87 days, which was less than the LOS for the control subjects (5.6 days). Although the control subjects were based on the full cohort of 245 subjects, the characteristics of the 238 patients were not significantly different from the full 245. Total LOS was 7.11 days (not significantly different from the 7.28 days of the full cohort). Subjects who received BVA on day of admission had had a highly significant ($p < 0.001$) lower total LOS than controls: 2.04 vs. 4.56 days. The subset also had highly significant outcome improvements (like the larger group, as reported previously): 30-day readmission was 12.7% vs 25.4% for controls ($p=0.02$), and 365-day mortality was 4.2% vs 27.1% for controls ($p < 0.001$).





DISCUSSION

The significant shortening of LOS for the subset of patients receiving BVA on day of admission suggests that the significant improvements of outcomes (lower mortality and readmission) can be achieved efficiently. For the larger cohort, it is not possible with this dataset to determine whether the care initiated for the subjects before the BVA results were known (a time of 2.25 days on average) contributed positively or negatively to the overall length of stay. In some cases, the initial treatment decision may have been confirmed by BVA, in which case the overall LOS would be an accurate estimate of the LOS if BVA information had been known immediately. In other cases, however, BVA was ordered for various subjects after patients failed to respond positively to initial treatment; in these cases, it is likely that the post-BVA LOS would be an accurate estimate of the LOS; in cases where treatment was reversed (for example, when diuresis was halted for patients shown by BVA to not actually have intravascular volume overload) it may be the case that post-BVA LOS is an over-estimate, given that some time may have been required to overcome the iatrogenic effects of sub-optimal treatment. The 71 cases where BVA was performed on the day of admission provide a direct comparison and resulted in markedly lower LOS.

CONCLUSIONS

A cohort of 71 patients who received BVA-guided treatment on the day of admission to the hospital had both markedly lower LOS and significantly improved outcomes (lower 30-day readmissions and 365-day mortality) than propensity-matched controls.

REFERENCES

1. J. E. Strobeck, J. Feldschuh, and W. L. Miller, "Heart Failure Outcomes With Volume-Guided Management," *J Am Coll Cardiol HF*, vol. 6, no. 11, pp. 940–948, 2018, doi: 10.1016/j.jchf.2018.06.017

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