

## Two-fold Increase in the Number of Total Nucleated Cells in the Bone Marrow Concentrate Obtained From Bone Marrow Aspirate May Not Be Ideal: Letter to the Editor

### Dear Editor:

We read with great interest the article “Single- Versus Multiple-Site Harvesting Techniques for Bone Marrow Concentrate” by Oliver et al.<sup>4</sup>

Although the sample numbers in the study were small, it was an elegantly conducted study. We noticed that the bone marrow aspiration (BMA) numbers were impressive. However, the bone marrow concentration (BMC) numbers were very disappointing, primarily because the number of total nucleated cells (TNCs) in the BMC increased approximately only 2-fold compared with BMA. Based on our calculations, only about 25% of the TNCs were captured in the BMC, while 75% were lost in the concentration process. This was consistent in both arms of the study. Conversely, the platelet concentration increased about 4-fold after centrifugation, but TNCs increased only 2-fold. We are left to believe that either the machine used for concentration was not ideal for TNC concentration or the machine settings were not optimal. Although we use the same machine in our clinic, the BMC TNC counts are consistently above  $200 \times 10^3/\mu\text{L}$ , which is approximately 5 times the number quoted in this study. We use a 25% hematocrit setting, unlike the 12% setting in this study. We are not convinced that this difference in the settings accounts for the vast difference in the numbers. We would appreciate knowing the authors’ opinion regarding their low TNC count in BMC.

For clinical use, the low BMC TNC counts in this study are unacceptable. Based on the work of Hernigou et al,<sup>3</sup> Centeno et al,<sup>2</sup> and Pettine et al,<sup>5</sup> patients’ clinical response seems to be dose related.

Additionally, we observed that the authors’ aspiration technique is good. This is reflected in the BMA TNC counts, which are ideal. Also, a multiple-site technique resulted in about 30% more TNCs than a single-site technique for both BMA ( $31$  vs  $22 \times 10^3/\mu\text{L}$ ) and BMC ( $65$  vs  $44 \times 10^3/\mu\text{L}$ ). This did not reach statistical significance. However, we believe that if the centrifuge had created at least a 4-fold (instead of

2-fold) increase in the BMC TNCs, this difference in TNC numbers would have been magnified and would have reached statistical significance. We admit that this is pure speculation. The BMC TNC counts in this study also pale in comparison with the numbers previously quoted in other studies. In the case series by Centeno et al,<sup>1</sup> the average BMC TNC was  $257 \times 10^3/\mu\text{L}$ . Most patients in this study<sup>1</sup> had good clinical outcomes, reflecting the importance of high BMC TNC counts. Although the high numbers in this study<sup>1</sup> were partly due to manual extraction of TNCs after centrifugation, the difference in TNC counts is too vast to ignore.

We appreciate the authors’ study of an important subject in this new and rapidly developing field of regenerative medicine.

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The authors declared that there are no conflicts of interest in the authorship and publication of this contribution. AOSSM checks author disclosures against the Open Payments Database (OPD). AOSSM has not conducted an independent investigation on the OPD and disclaims any liability or responsibility relating thereto.

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