At Issue:

The Quality of
Bone Marrow Biopsy (Trephine) Samples

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The role that pathologists play in the examination of diseases of the hematopoietic system is a critical one, and it is one that they must undertake while dealing with a number of significant challenges. These challenges include analyzing bone marrow samples whose quality can vary considerably. Yet, the quality of these samples has everything to do with the accuracy of a report on which clinicians depend for treating and monitoring patients who may be seriously ill.

Clearly, variable consistency of samples makes interpretation difficult.[1,2] In one important study the investigators noted that only 42% of 764 biopsy samples they collected were adequate.[3] In another study, researchers reported that up to 50% of their pediatric core biopsy specimens were inadequate.[4] These are percentages that are highly problematic for pathologists who are working with an organ system that exists within a highly dynamic context. Technology that could provide more assurance that samples of consistent quality can be acquired would be a great advantage both to those who analyze the samples and those whose clinical judgment rests on this analysis.

The procedure of collecting a bone marrow biopsy (trephine) presents two problems: the necessity of manipulating the needle to successfully capture a core and the need to acquire a sample of sufficient size so that focal areas of involvement can be seen in diseases that have a tendency to show spotty involvement. The best aspirate and core samples have minimal distortion and good cell viability.

The manipulation of the needles used to retrieve core samples is an influential factor in the quality of the samples; the less manipulation, the less potential of crush artifact and trabecular distortion. Also, the less manipulation of the needle during the biopsy procedure, the greater the possibility of collecting an intact sample of sufficient size. Core length and width are essential, because both can decrease by an average of 28% and 42% after fixation.[4] When this occurs, the procedure must be repeated or an open biopsy performed[5], exposing patients to additional pain and risk and the healthcare system to increased costs.

Patients report the greatest pain in bone marrow procedures to be during the manipulation of the needle when retrieving the core specimen. A technique that could reduce the need for manipulation would be a benefit not only to the operator but also to the patient, especially when lesions several centimeters below the bone cortex must be accessed. Reducing the need for forceful manipulation offers the potential to minimize the trauma to which the patient and clinician are subjected. Years of performing bone marrow biopsies can have physical consequences to the clinician.

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Although bone marrow procedures are commonly performed, the technology associated with them has not changed substantially over many years. However, with the introduction of the OnControl™ Bone Marrow Aspiration and Biopsy System, this is about to change. The system is based on one developed to access the intraosseous space via a lithium-powered driver for the purpose of delivering life-saving fluids and medications. This space is a non-collapsible vein to which fluids and drugs can be delivered that arrive in the central circulation within seconds. The significant advantage of this technology reported in clinical studies so far is the speed of getting into the intramedullary space. This results in minimal patient pain, important because the duration of the procedure seems to be more highly correlated with pain intensity, than age, gender, or body mass index.[6] In addition, a pathologist now involved in trialing the OnControl system in pigs reports that the speed and ability to access the marrow without needle manipulation appears to offer more consistent quality of samples compared with standard manual methods. (Personal communication, C. Spadaccini, M.D.)

In summary, the quality of bone marrow cores has an essential role in the accurate diagnosis and monitoring of diseases of the hematopoietic system. Quality is highly variable among samples collected using manual needles, in part because of the need for heavy manipulation in patients with dense bones. A new system utilizing a powered driver allows speedy access to the marrow space and appears to offer more consistent quality of samples compared to standard, manual methods. This promises to be a step forward for a procedure in which technology advances have not occurred in decades.

References

1. Hasserjian R. Reactive versus neoplastic bone marrow: problems and pitfalls. *Arch Patho Lab Med* 2008; 132: 587-594.
2. Roberts CC, Morrison WB, et al. Assessment of bone biopsy needles for sample size, specimen quality and ease of use. *Skeletel Radiol* 2005; 34: 329-335.
3. Bishop FW, McNally K, Harris M. Audit of bone marrow trephine biopsy. *J Clin Path* 1992; 45: 1105-1108.
4. Reid MM, Ronald B. Adequacy of bone marrow trephine biopsy specimens in children. *J Clin Path* 1996; 49: 226-229.
5. Hopper KD, Grenko RT, et al. Percutanous biopsy of the liver and kidney by using coaxial technique: adequacy of the specimen obtained with three different needles in vitro. *J Roentgenol* 1995; 164: 221-224.
6. Kuball K, Schuz J, Gamm H, Weber M. Bone marrow punctures and pain. *Acute Pain* 2004; Vol 6, Issue 1: 9-14.