| **Design** | **Additional Features/Specifications, Compared to Original Jamshidi Needle** | **Criteria Met/Problems Addressed Based on Specs** | **Diagram:** |
| --- | --- | --- | --- |
| Original Jamshidi Needle [1] | This is the reference design for all other designs described in this table as well as for the proposed design. This is because the doctors who were contacted were all familiar with this needle and stated that it was the most popular needle for bone marrow biopsy procedures. Since doctors are familiar with this needle, the design should utilize what the primary stakeholder is comfortable with and make that easier to use, rather than designing a completely new needle that would require training, hindering the likelihood of widespread use by clinicians.   * Tapered distal tip allows sample to be obtained without altering architecture * Sharp bevel tip allows effective coring of the bone * Single-use | * Cost efficient * Easy to use, due to widespread use * Manufacturability, due to widespread use, so many are manufactured * Shelf life | Overview of the device:    Stylet protruding through the cannula: |
| T-Handle Jamshidi Needle [2] | * Crown tip on trocar and stylet * Allows multiple sampling to prevent painful redirection * Provides tactile feedback * Increased control during needle insertion * More comfortable handle design | * Specs indicate ease of use * Easier to use would indicate less procedural time and therefore less pain experienced * Shelf life | Handle:  http://www.carefusion.com.au/Images/Interventional_Specialties/t-handle-jamshidi_carousel-1.jpg  Trocar-tip stylet and triple crown tip cannula:    Bone marrow sample on the cannula tip: |
| Illinois Hamshidi Needle [3] | * Indicated for pediatric intraosseous infusion * Luer slip and luer lock syringes fit securely | * Indicated for pediatric use therefore not relevant in this context | Overview of the device: |
| SnareLok Bone Marrow Biopsy Needle [4] | * Patented SnareLok design at the needle tip captures intact specimens to improve diagnostic evaluation * “Double-diamond” stylet point allows for quick and easy penetration into marrow cavity * ‘Twin-peaks’ cutting edge on tapered cannula tip provides superior biopsy coring ability * 13G option contains internal coil technology ensures specimens are intact | * Ease of use * Sample retention | Double diamond stylet point:    Internal Coil Technology: |
| TrapLock Bone Marrow Biopsy Needle [4] | * ‘Twin-peaks’ cutting edge on tapered cannula tip provides superior biopsy coring ability and easy penetration into marrow * ‘Double-diamond’ stylet point for quick and easy penetration into marrow cavity * Forceps at the tip to ensure specimen is captured and able to be extracted * Marked probe indicates length of specimen | * Ease of use | Forceps at tip: |
| Bone Marrow Harvest Needle  [4] | * Option to have side holes to enhance harvesting of bone marrow * Increased torque without hand fatigue due to comfortable handle with and without stylet in place | * Easy to penetrate tissue * Side holes may allow for better sample yield | With holes at tip:    Without Holes at Tip: |
| Arrow OnControl Powered Bone Marrow Biopsy System  [5] [6] | * Drill-powered bone marrow biopsy needle * Threaded cannula captures and holds specimens | * Targets difficulty to penetrate bone issue * Retains sample to prevent sample loss | Drill and needles:    Threaded cannula: |
| Bonopty  [7] | * Gains access through thick cortical bone * Coaxial system facilitates multiple sampling * Excellent core samples with few crush artifacts | * Targets difficulty to penetrate bone issue * Targets contamination of sample issue | Stylet and cannula: |
| Bard Ostycut  [8] | * Two-part needle design enables smoother penetration * Flat-threaded cannula optimizes performance | * Easy to use due to smoother penetration | Overview of the device: |
| Monoject Snarecoil Bone Marrow Needle [9] | * Coil mechanism that eliminates need to rock or twist needle to fracture bone marrow sample and retain it within the needle | * Retains sample | http://products.covidien.com/imageServer.aspx/doc73395.0.201.34/Kendall_Internet/Catalog/images/snarecoil.jpg?contentID=3917&contenttype=image/jpeg |

[1] <http://www.merckvetmanual.com/media/vet/photos/media/photos/blunt_stylet_of_jamshidi_needle_for_bone_marrow_biopsy.jpg>

[2] Mooremedical.com,. 'Jamshidi® Bone Marrow Needle From Carefusion Solutions - Buy Online From Moore Medical'. N.p., 2015. Web. 25 Nov. 2015.

[AR5] <http://www.alibaba.com/product-detail/5-600-bar-ceramic-pressure-sensor_60154209720.html?spm=a2700.7724838.30.32.dchRkh&s=p>

[AR6] <http://media.digikey.com/photos/Measurement%20Specialties%20Photos/M5154-000004-10KPG.JPG>

[AR7] http://www.digikey.ca/product-detail/en/511-8001-KIT/511-8001-KIT-ND/

[8] <http://www.bardbiopsy.com/products/ultrawire.php>