Research Article

Bone marrow aspiration in hematology and oncology-10cc versus 50cc syringe

Bonanthaya R[1], Naveen .T[2], K.B. Lingegowda[3]

[1]Dr. Ravikiran Bonanthaya[*], [2]Dr. Naveen .T[+], [3]Dr. Lingegowda. K.B [#]

[*]Assistant Professor, Department of Radiation Oncology, Kidwai Memorial Institute of Oncology, Bengaluru, India.

[+]Associate Professor, Department of Radiation Oncology, Kidwai Memorial Institute of Oncology, Bengaluru, India.

[#] Professor, Department of Anesthesiology and Palliative Care, Kidwai Memorial Institute of Oncology, Bengaluru, India.

Address for Correspondence: Dr RavikiranBonanthaya, Department of Radiation Oncology,Kidwai Memorial Institute of Oncology, Bengaluru, India, Email:ravikiran.bonanthaya@gmail.com

……..

Abstract

Aims: To compare efficacy of Bone Marrow Aspiration (BMA) using 10cc syringe versus 50cc syringe in hematology and oncology.**Introduction:** Bone Marrow Aspiration is an important investigation in diagnostic hematology and oncology. While the procedure of BMA has been standardized, the optimal size of the syringe to be used is still uncertain.**Methods:** It is a retrospective analysis involving 300 patients undergoing diagnostic Bone Marrow Aspiration (BMA) at our institute over a period of two years.10 cc syringe was used in 149 patients and 50cc syringe in 151 patients.The results were analyzed using MEDCALC version 7.5 for WINDOWS software. **Results:** 65 patients (43%) in the 50cc arm and 60 patients (40%) in 10cc arm had adequate volume of aspirate which resulted in a conclusive report suggesting that the 50cc syringe may be better than 10cc syringe.The use of 50cc syringe also resulted in lesser number of inadequate aspirate, inconclusive reports and dry taps. The differences between the 10cc and 50cc arms were not statistically significant though. **Conclusion:** Bone Marrow Aspiration (BMA) using 10 cc syringe was as effective as BMA using 50cc syringe in diagnosis of hematology and oncology.

Key words: Bone marrow aspiration, Syringe, Hematology, Oncology and Diagnostic Hematology

……..

Introduction

Bone marrow aspiration is a cardinal diagnostic procedure in hematology and oncology practice.It is usually done in combination with other investigations like peripheral smear examination, cytogenetics, flow cytometry and other relevant clinical investigations [1].The procedure of BMA is challenging considering the fact that it is interventional and involves various factors like age of patient, site, type of disorder, volume of aspirate, technique of smear preparation and technique of trephining [2].One of the issues involved in obtaining an ideal BMA is the volume of the syringe used for aspiration.Various studies in the literature have thrown light on the syringe size to be used, which varies from 2cc to 100cc[1,2,4]. While there is no conclusive evidence for use of any one particular size syringe in BMA, the most commonly used size is 10cc syringe. With this background, we embarked on a retrospective study to conclusively prove the best syringe size to be used for BMA in diagnostic hematology and oncology.

Manuscript received: 3rd March 2016
Reviewed: 15th March 2016
Author Corrected: 26th March 2016
Accepted for Publication 8th April 2016

Methods and Materials

The study was a retrospective one conducted at Kidwai Memorial Institute of Oncology, Bangalore. We analyzed the diagnostic efficacy of BMA using 10cc versus 50cc syringe in 300 patients with suspected

hematological malignancy and solid tumors with suspected bone marrow involvement at our oncology department over a period of two years.10cc syringe was used in 149 patients while 50cc syringe was used in 151 patients. The choice of syringe was based on the availability at that point in time, which is dependent on the hospital supply.

Inclusion criteria:

1.Patients with suspected hematological malignancy.

2.Patients with suspected bone marrow involvementfrom solid tumors.

3.Karnowsky performance status above 60.

4.Age more than or equal to 30 years.

Exclusion criteria:

1. Karnowsky performance status equal to or below 60.
2. Platelet count below 20,000.
3. Age less than 30 years.

The variables in the two arms were well matched and are shown in table 1.

Procedure: After obtaining a written informed consent, the patients were positioned in the lateral position and with sterile precautions, the parts were draped and bone marrow trephining was done under local anesthesia. Any one of the two commercially available disposable BMA needles or a reusable steel needle was used (brand 1,2 and 3 respectively). Any one of the syringes was used for aspirating the bone marrow, either 10cc or 50cc based on the availability at that point of time. With a gentle negative pressure, 1.5 to 10ml aspirate was drawn into the syringe. A smear was prepared bedside and air dried before immediately dispatching to the lab for staining and viewing under the microscope. The duration of each procedure, number of attempts and the time for reporting were comparable between the two arms and is depicted in table 2. The results were analyzed by Student's 't' test using MEDCALC version 7.5 for WINDOWS software and tabulated as shown in table 3.

Results

The results were classified into groups based on the adequacy of the aspirate and the conclusiveness of the final report as follows.

Group 1: Adequate aspirate, conclusive report.

Group 2: Adequate aspirate, inconclusive report.

Group 3: Inadequate aspirate.

Group 4: Dry tap.

Table 1: Distribution of groups.

SL.No.	Variable	10cc	50cc	T Value	P Value
1.	Age (Years)	45.5+/-13.2	42.2+/-6.68	0.062	0.543
2.	Aspirate Volume (Range in ml)	3.35+/-0.74 (2.5-5)	4.25+/-2.38 (1.5-10)	1.14	0.268
3.	Sex M F	 80 69	 78 73	 -	 0.9
4.	KPS	87+/-5	90+/-6	-	0.8
5.	Procedure By Consultant Trainee	 39 110	 52 98	 -	 0.9
6.	Needle Brand 1 2 3	 104 30 15	 45 90 16	 -	 1.0

Variables like age of patient, aspirate volume, sex and brand of needle were well matched between the two arms. The same group of clinicians conducted all the procedures thus maintaining uniformity.

Table 2: Procedure duration & attempts.

SL.NO.	Variable	10cc	50cc	P Value
1.	Duration of Procedure (Minutes)	12+/-1.25	12.4+/-0.79	NS
2.	No. of Attempts	2.0+/-1	2.0+/-1	NS
3.	Time For Reporting (Days)	3.5+/-1.5	3.5+/-1.5	NS

The duration, over which the procedure was done, the number of attempts and the time duration for reporting was also similar between the two arms.

Table 3: Sample adequacy group distribution

Group	10cc	50cc	P Value
1	60(40%)	65(43%)	0.29
2	44(30%)	43(29%)	
3	30(20%)	29(19%)	
4	15(10%)	14(9%)	

65 patients(43%) in the 50cc arm and 60patients (40%) in 10cc arm fell in the group 1 suggesting that the 50cc syringe may be better than 10cc syringe.The remaining groups 2,3 and 4 also showed results favoring the use of 50cc syringe.

The differences between the 10cc and 50cc arms were not statistically significant.

Discussion

BMA is a challenging procedure considering the fact that it involves proper selection of site, standardization of techniques, optimal processing of the aspirate, systematic analysis of the slides and precise reporting in the light of the overall clinical picture of individual patients.

The procedure begins with an informed consent followed by positioning, sterile precautions,local or general anesthesia, selection of trephining needle of ideal length, use of a suitable syringe, application of the correct negative pressure, collection of sufficient aspirate material of good quality and reporting the findings after proper preparation of the slides.

Most of the components of the above said procedure are subjective and is done at the discretion of the clinician performing the procedure, which may result in variation in the results obtained. The procedure of BMA has been explained in detail by various investigators and groups [2,4,7].

Although the steps of the BMA procedure have been standardized, the size of syringe to be used to obtain optimal results is not.Various investigators have attempted to address this issue in the setting of bone marrow transplant [1,5,6] but none in diagnostic hematology oncology.

A French study concluded that smaller syringe (10cc) resulted in harvest of more number of mesenchymal stem cells than larger (50cc) syringe [1].It is a well known principle of fluid dynamics that pressure=force /area which means that for similar force applied, syringes with smaller area of the plunger surface generate higher negative pressure compared to syringes with larger surface area of the plunger [1]. The exact mechanism by which this concept can affect the quality of the aspirate is not clear.

BMA is also done for confirmation of metastasis to bone marrow in advanced solid malignancies [9,11,13,14,15]. BMA is done in conjunction with Bone Marrow Biopsy (BMB) to enhance the accuracy of diagnosis. At our Centre we generally do not perform BMB unless warranted as in case of inconclusive BMA in the face of stark clinical indication of marrow involvement, which manifests as pancytopenia and marrow failure.

At our oncology center we routinely use 10cc syringe for BMA. At times there is a shortage of 10cc syringes when we use 50cc syringes alternatively till the 10cc syringe stocks are replenished. We used this opportunity to retrospectively analyze the effect of 10cc syringes versus 50cc syringes on the quality of aspirate and finally on the reports obtained.

We selected 149 patients in the 10cc arm and 151 patients in the 50cc arm all of who were adults. The same group of clinicians did all the procedures.

The two arms were well matched with respect to the variables like age, sex, BMA needle, volume of aspirate, clinician performing the procedure, etc.

Arm B had higher numbers of group 1 compared to arm A while the opposite was true for groups 2,3 and four suggesting that 50cc syringe could be better than 10cc with respect to the adequacy of sample and conclusiveness of the report but the difference was not statistically significant. Based on the above results we concluded that the size of the syringe made no difference with respect to the aspirate quality or the conclusiveness of the final report in hematology and oncology but there was a trend in favor of the 50cc syringe arm, which needs to be tested in a prospective study.

Dry tap is usually encountered in cases of Myeloproliferative Disorders, Myelodysplastic Syndrome, MyeloproliferativeNeoplasia, Chronic Myeloid Leukemia in Blast Crisis, Hairy Cell Leukemia and in marrow failure due to florid metastasis to the bone marrow from solid malignancies. The causes and techniques to circumvent dry tap has been discussed by Humphries et al [8]. We found that using 50cc syringe resulted in lesser number of dry taps compared to using 10cc syringe although the differences between the two arms were not statistically significant.

In addition, BMA being an invasive procedure is associated with severe pain locally. Many investigators have evaluated the role of various interventions in reducing the pain at the site of BMA [12]. It remains to be seen if the size of the syringe has any bearing on the intensity of pain during the procedure.50cc syringe seemed to induce greater pain locally when compared to 10cc syringe although we did not evaluate this issue systematically.

We hope to study this in a future prospective study.

Conclusion

BMA using 10cc syringe was as effective as BMA using 50cc syringe in the diagnosis of hematology and oncology conditions. Future prospective studies are needed to confirm this result.

Author's disclosure:

There is no conflict of interest.

We have no disclosures to be made.

Funding: Nil,
Conflict of interest: None.
Permission of IRB: Yes

References

1. Bain BJ. Bone marrow aspiration.J ClinPathol. 2001 Sep; 54(9):657-63.

2. Lee SH, Erber WN, Porwit A, Tomonaga M, Peterson LC; International Council for Standardization In Hematology. ICSH guidelines for the standardization of bone marrow specimens and reports.Int J Lab Hematol. 2008 Oct;30(5):349-64. doi: 10.1111/j.1751-553X.2008.01100.x.

3. Hernigou P, Homma Y, FlouzatLachaniette CH, Poignard A, Allain J, Chevallier N, Rouard H. Benefits of small volume and small syringe for bone marrow aspirations of mesenchymal stem cells.IntOrthop. 2013 Nov;37(11):2279-87. doi: 10.1007/s00264-013-2017-z. Epub 2013 Jul 24.

4.Tripathy S, Dudani S. Comparative Evaluation of Simultaneous Bone Marrow Aspiration and Trephine Biopsy-Experience From Routine Hematology Practice, Indian Journal of Clinical Practice, 2013, Vol. 24, No.5.

5. Muschler GF, Boehm C, Easley K. Aspiration to obtain osteoblast progenitor cells from human bone marrow: the influence of aspiration volume. J Bone Joint Surg Am. 1997 Nov;79(11):1699-709.

6.Owen M, Friedenstein AJ.Stromalstem cells: marrow-derivedosteogenic precursors. Ciba Found Symp. 1988;136:42-60.

7. Riley RS, Hogan TF, Pavot DR, Forysthe R, Massey D, Smith E, Wright L Jr, Ben-Ezra JM. A pathologist's perspective on bone marrow aspiration and biopsy: I. Performing a bone marrow examination. J Clin Lab Anal. 2004;18(2):70-90.

8. Humphries JE.Drytapbone marrowaspiration: clinical significance. Am JHematol. 1990 Dec;35(4):247-50.

9. Ozkalemkas F, Ali R, Ozkocaman V, Ozcelik T, Ozan U, Ozturk H, Kurt E, Evrensel T, Yerci O, Tunali A. The bone marrow aspirate and biopsy in the diagnosis of unsuspected nonhematologic malignancy: a clinical study of 19 cases. BMC Cancer. 2005 Nov 1;5:144.

10. Charles KS, Winfield DA, Angel C, Goepel J. Audit of bone marrow aspirates and trephine biopsies in multiple myeloma--a single centre study. Clin Lab Haematol. 2004 Dec;26(6):403-6.

11. Roeckel IE. Diagnosis of metastatic carcinoma by bone marrow biopsy versus bone marrow aspiration.Ann Clin Lab Sci. 1974 May-Jun;4(3):193-7.

12. Marec-Berard P, Montella A, Schmitt C, et al. Evaluation oflidocaine infiltration efficiency for pain relief during bone marrow aspiration in children with cancer. Adv Pediatr Res, 2015, 2:7. doi:10.12715 /apr.2015.2.713

13. Basu D, DasS, JacobSE, KarR, MishraP, hematopoietic malignancies metastasing to the bone marrow: A 5 year record-based descriptive study from a tertiary care Centre in South India,Indian Journal of Cancer, January-March, 2014, Vol. 51, No. 1, pp. 30-34,DOI: 10.4103/0019-509X.134614.

14. Brahmbhatt B, Parikh B, Shah M. Bone Marrow involvement by Metastatic solid Tumors Gujarat Medical Journal, 2014, August Vol.69 No. 2; 54-57.

15. Singh MK, Goel MM, Singh U S, Dalela D, Shankhwar S N, Kumar A. Detection of bone marrow metastases in prostate cancer: Role of trephine biopsy and Immunohistochemistry. Clin Cancer Investig J 2013; 2:319-24.

…….

How to cite this article?

Bonanthaya R, Naveen .T, K.B. Lingegowda, Bone marrow aspiration in hematology and oncology-10cc versus 50cc syringe: *Int J Med Res Rev* 2016;4(4):587-591. doi: 10.17511/ijmrr.2016.i04.19.

……