Preliminary Tests and Progress Report of Multiple Myeloma Using Computer Vision and NLP

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Abstract – Multiple myeloma refers to bone marrow cancer which is the most common amongst all. For the detection of it various methods are being used which include MRI, biopsy, CT-scan and bone marrow examination.The methods are invasives.This work proposes a system in which the eradication of existing systems will be performed. In, this approach a chip will be designed using trabecular titanium (TT) to identify and report the progress or declination of the cancer.The proposed method will be evaluated on matlab using real clinical images.

Index Terms – Trabecular titanium , Multiple Myeloma , EBM and MGUS

1. INTRODUCTION

The proposed system emphasis on the eradication of invasives that are already present in the existing system. A chip has been designed using trabecular titanium which has high porosity percentage of (65%) with a pore diameter of 640m. It has some advantageous properties like corrosion free,light weighted,excellent biocompatibility etc. The discussed chip has the appropriate data that has all the data regarding the disease.

2. INITIATION

Multiple myeloma grows in B lymphocytes and after they depart from the portion of the lymphatic node known as germinal center. The cell line that has been linked with respect to MM cells subsequently taken activates the memory of B cells or the parent to plasma cell, the plasmablast.

The immunity system inculcates the outgrowth of b cells and the releasing of antibodies under strict supervision. Whenever the genes and chromosomes get deteriorated, often through the rearrangement necessity, the control is lost completely. Apparently, a promoter gene swifts (or altered) to a chromosome where it stimulates an antibody gene to overproduce the cells.

A chromosomal alteration inside the immunoglobulin heavy chain gene (chromosome 14, locus q32) and an oncogene(often 11q13) is likely to be seen in patients suffering from multiple myeloma.

Mutations results in disproportion of oncogene which is suppose to be a fundamental starting event in the progression of myeloma. The outcome is outgrowth of a plasma cell cloned and genomic instability that directs to further mutations and alteration.

2.1.PLASMA CELL NEOPLASM

The abnormal outgrowth of the plasma cell is a disease called plasma cell neoplasm.It can be benign(non cancerous) or malignant(cancerous) .Different types of them are enlisted below.

- MGUS
- Plasmacytoma
- Multiple myeloma

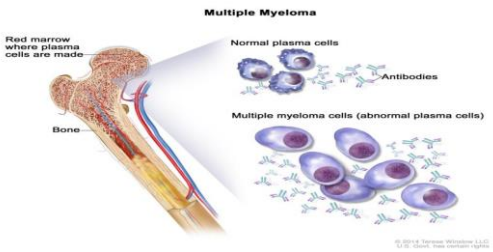


Figure 1 multiple myeloma

S.NO	CELL LINES LIST		
	NAMES	ORIGIN	CELLOSAURUS
1	HEL	Peripheral blood	Cancer cell line
2	NB-4	Bone marrow	Cancer cell line
3	HAP1	Leukemia	Cancer cell line
4	HL-60	Peripheral blood	Cancer cell line
5	HMC-1	Peripheral blood	Cancer cell line
6	K-562	Pleural effusion	Cancer cell line

2.2. CHIP FUNCTIONING

1. ***FIRST STEP-*** The chip will be made of trabecular titanium which enables the doctor to insert it inside the patient body and will stick to the bone marrow.It will record all its functioning of plasma cells. Counts the number of proliferation occurred and analyse if its benign or malignant.
2. ***SECOND STEP-*** If the patient is positive with the malignant plasma cells. the chip will record its functionality and will show the growth of them using matlab.The high porosity level of trabecular titanium will allow the doctor to have a look in depth of the cancer.
3. ***THIRD STEP-*** After looking at the cancerous disease using matlab. The chip will also give a suggestion for further medication while analysing the pattern of the growth.Furthermore whenever the patient will come for the check up , examination of the chip my simply doing ultrasound will tell the progression or declination of the bone marrow using matlab.

3 .ADVANTAGES OF THE SYSTEM

The above proposed system is has following advantages over other systems:-

- Efficient in nature than other systems since it uses trabecular titanium.
- The system is patient friendly and eliminates the various painful test procedures.
- Eradicate the chances of developing new problems via test procedures.
- Highly technological system with minimal human error.
- Non harmful to human body.
- Real time picturizations are provided for the treatment.
- Progressively cheap other than the other existing systems.
- Readings for the doctor's perspective is easy to examine.

4 .DIAGRAMMATICAL ANALYSIS

Below are the diagrams representing following:

THE ANALYSIS OF TRABECULAR TITANIUM AND TITANIUM WITH RESPECT TO POROSITY, ALLOYS,WEIGHT AND CORROSION.

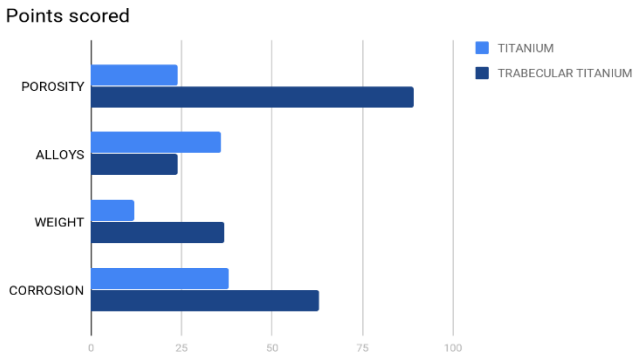


Figure 2 A BAR GRAPH REPRESENTING THE SAME.

THE BAR GRAPH THAT HAS BEEN SHOWN IS THE STATISTICAL PROOF OF THE MATERIALS NATURE THAT HAS BEEN USED IN MAKING THE CHIP.

THE INFORMATION THAT HAS BEEN PROVIDED CONTAINS ALL THE ESSENTIAL COMPONENTS THAT SHOULD BE KEPT IN MIND FOR USING IN BONE MARROW CANCER.

"TRABECULAR TITANIUM IS NOT A COATING RATHER IT IS A UNIQUE COMBINATION OF AN INTERCONNECTED GEOMETRIC STRUCTURE AND TITANIUM THAT HAS HIGH PROPERTIES THAN THE ION OF TITANIUM."

TRABECULAR TITANIUM IS VERY VERSATILE BECAUSE OF ITS 3D PRINTING, IT ALLOWS THE IMPLANT COMPONENTS WITH ANY 3D DESIGN.THIS METHOD OF TECHNOLOGY OVERCOMES THE TECHNOLOGICAL LIMITATIONS OF TRADITIONAL

ORTHOPEDICS PRODUCTIONS THAT HAS INDICATED THE EXPOSURE TO OSTEOGENESIS.

Figure 3 STRUCTURE OF TRABECULAR TITANIUM

4.1. PROCESS OF THE PROPOSED SYSTEM

THE PROCESSES INVOLVE THE WAYS ON HOW THE PATH WILL BE FOLLOWED FOR THE EXISTING SYSTEM.

THE DIAGRAM BELOW IS EXPLAINING THE EXACT PROCEDURAL STEPS TO ATTAIN THE GOAL.

1. THE CHIP MADE FROM TRABECULAR TITANIUM SHOULD BE INSERTED IN THE BONE MARROW AS SOON AS POSSIBLE TO ANALYSE THE PROLIFERATION OF PLASMA NEOPLASM. THE CHIP ALLOWS THE ACCESS TO DETECT WHETHER THE GROWTH IS BENIGN OR MALIGNANT.
2. AFTER THE DETECTION IF THE CELLS ARE FOUND TO BE MALIGNANT THEN THE DETECTION OF THE CANCEROUS CELLS WILL TAKE PLACE TO IDENTIFY IF ITS MYELOMA, LYMPHOMA OR LEUKEMIA. BEING THE CELLS MYELOMA IN NATURE FURTHER INVESTIGATION WILL TAKE PLACE TO FIND THE RATE AT WHICH IT IS INCREASING.
3. THIRD PROCESS INVOLVES THE REAL TIME IMAGING USING MATLAB THAT WILL BE HELPFUL IN PROVIDING THE PROGRESSIVE OR DECLINATION REPORT OF THE MYELOMA. ALSO FOR THE BENEFICIAL PURPOSE OF DOCTORS, ADVISED MEDICATION WILL ALSO BE PROPOSED BY THE SYSTEM.

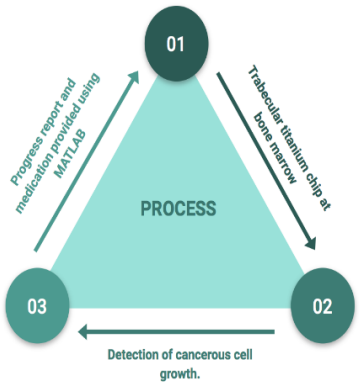


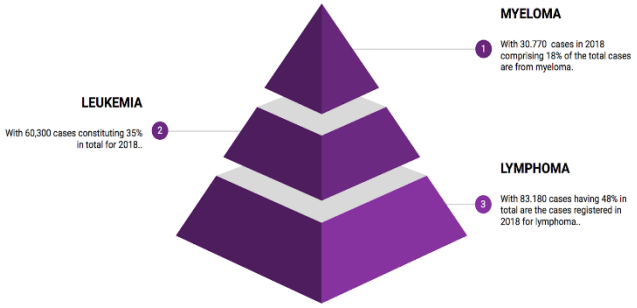
FIGURE 4 PROCESS OF THE SYSTEM

4.2. TYPES OF CANCERS AND THEIR PERCENTAGES

THERE ARE DIFFERENT TYPES OF BONE MARROW CANCERS THAT HAS TO SPOTTED AND CONSIDERED. SO FAR THREE TYPES OF CANCER THAT ARE MOST COMMON IN TODAY'S WORLD HAS BEEN CLASSIFIED ACCORDING TO THEIR PREDICAMENT AND PERCENTAGE.

THE HIGHEST POPULATION IS AFFECTED BY LYMPHOMA WITH 83,180 NUMBER OF PEOPLE COMPRISING 48% OF THE POPULATION. THE NEXT BAR IS TAKEN BY THE LEUKEMIA CANCER WITH 60,300 CASES CONSTITUTING 35% OF THE POPULATION.WITH MINIMAL YET EFFECTIVE, MYELOMA HAVE 30,770 CASES UNDER CONSIDERATION WITH 18% OF THE TOTAL.

LYMPHOMA USUALLY OCCURS AT LYMPH NODES OR AT THE LYMPHATIC SYSTEM.LEUKEMIA TYPICALLY STARTS IN BLOOD OR BONE MARROW AFFECTING THE PRODUCTION OF VITAL BLOOD CELLS WHEREAS MULTIPLE MYELOMA ATTACKS THE PLASMA CELLS AND MAKE ABNORMAL ANTIBODIES TO SETTLE THEM.



C(1).THE(FIGURE 5) DIAGRAMMATIC REPRESENTATION SHOWS THE STATURE OF DIFFERENT TYPES OF CANCERS WITH THEIR RESPECTIVE PERCENTAGES.

4.3. SUPPRESSION OF CELLS BY MYELOMA

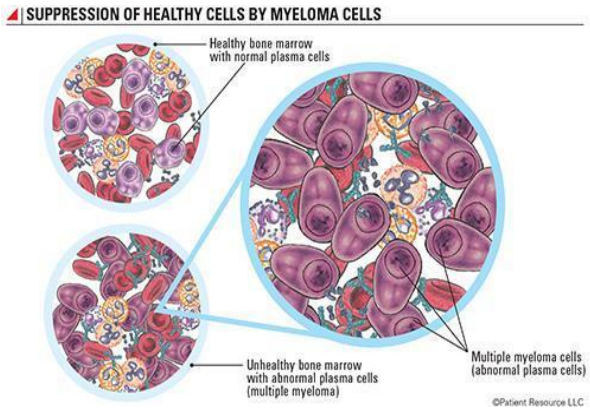


FIGURE 6 SUPPERESION OF HEALTHY CELLS

THE SUPPRESSION OF NORMAL CELLS BY MYELOMA IS THE ONSTAGE OF ABNORMALITY STARTING TO OCCUR AS AN INITIAL STEP.

DIAGRAM REPRESENTS THE NORMAL PLASMA CELLS AND THE SECOND ENLARGED IMAGE SHOWS THE ABNORMAL GROWTH OF PLASMA NEOPLASM THAT HAS BEEN TAKE OVER

5. NEED OF THE RESEARCH

The need of the research is knowing the importance of patient's suffering through the testing process of the entire disease. Some are the enlisted reasons for the research.

- More progressive way to determine and handle patient's condition.
- Better alternative provided in the field of medical.
- Suitable for doctor's prescribed medication.
- Usage of materials that has never been used for treating cancer.
- An overall check up on the condition of the proliferation.
- Betterment in assessment of the disease.
- More effective than any other existing system.
- Provides real time picturization.
- Accuracy of 89%.

6. GERMINAL CENTER EVOLUTION OF MYELOMA

The below diagram shows the representation of the germinal center evolution into myeloma.The first step involves the breakage into MGUS followed by smouldering myeloma. intramedullary myeloma can sometimes take place exactly after germinal center B cell but in most of the cases it happens after intramedullary myeloma.

The final step directs to myeloma cell line.

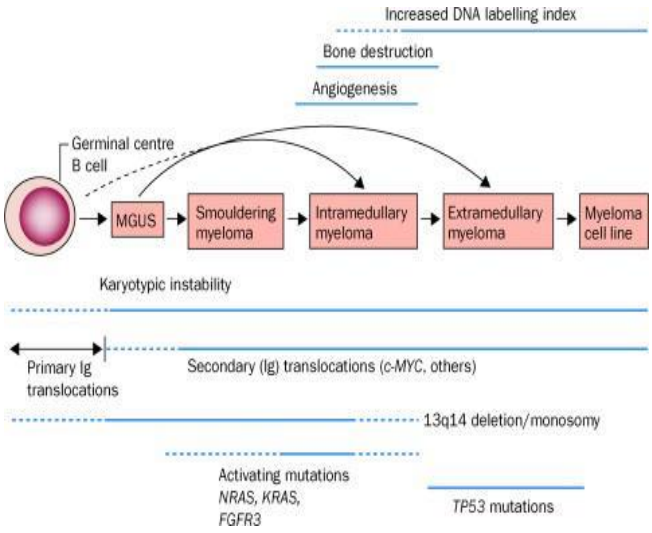


Figure 7 Functioning of cell

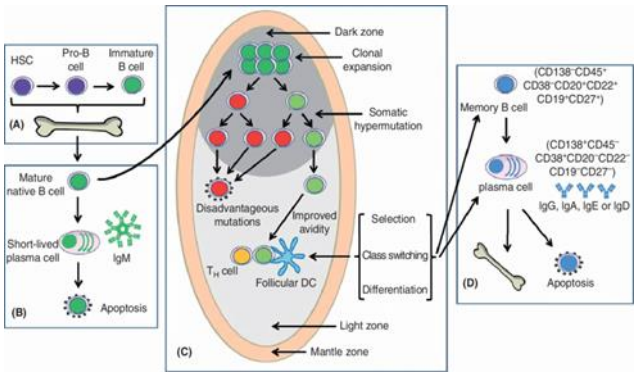


Figure 8 Functioning of germinal cell

The above image shows the malignancy of germinal center,terminally disoriented B cells which is a resident to BM. The image is the perfect classification of the germinal center which evolves the myeloma cell inside the plasma neoplasm.HSC,Pro-b and Immature B cell are some of the composition in bone structure. the diagram also explains the phenomenon of Apoptosis, selection, class switching and differentiation.The rightmost image shows the different components with their structure that covers under the topic class switching.

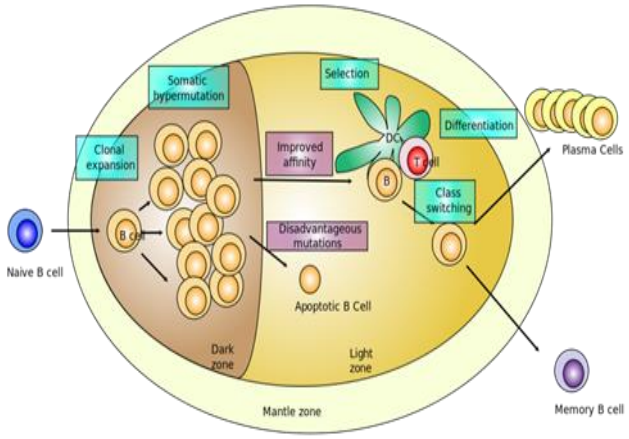


Figure 9 Structure of germinal cell

7. RESEARCHES DONE ON OTHER SPECIES AND RESULTS.

A commonly used cell line to evaluate therapies for multiple myeloma is MM.1S. MM.1S.It was taken from a 42 year old African American woman and has been bounded to show CD59, CD38, CD52, and CD25. glucocorticoid receptor is being used which is dexamethasone sensitive.The experiment shows the X-ray results of the mice. With bioluminescence imaging (BLI).It can distribute the disease progression over time and find reproducible growth in mice.following is the image that translates the image of the following images.

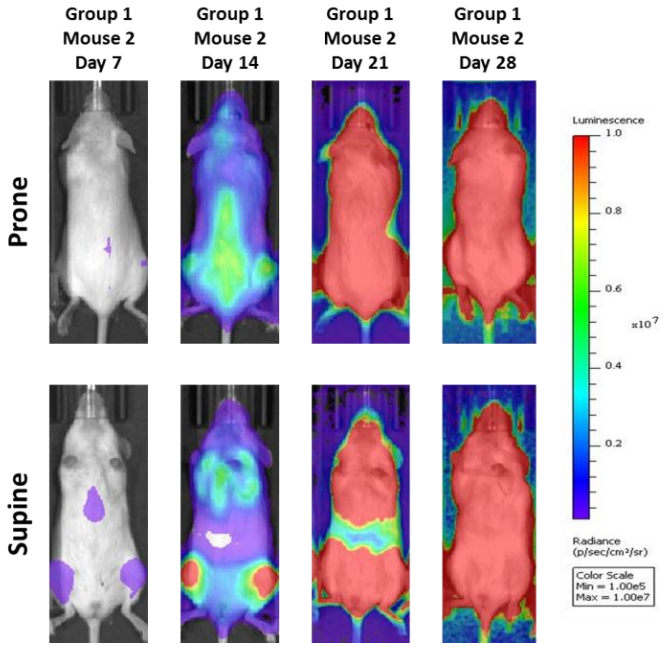


Figure 10 Research carried out

8. CONCLUSION

The proposed system concludes that the drawbacks existing systems can be eradicated by following this system.It has discussed and represented the best possible progressions in the curing multiple myeloma which consist of some modern technology. The system inculcates every aspect in the diagnosing to the medication purpose.

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REFERENCES

[1] Bioimplant Cited 2006 February Available from URL https://www.bioimplantcenter.com/titanium-vs-ceramic-implants

[2] Webmd cited 2007 february available from URL https://www.webmd.com/cancer/multiple-myeloma-symptoms-causes-treatment#1

[3] Ncbi gov cited 2007 february available from URL https://www.ncbi.nlm.nih.gov/pmc/articles/PMC2505148/

[4] Tandfonline cited 2006 february available from URL https://www.tandfonline.com/doi/full/10.1080/17453670610013510?scroll=top&needAccess=true&

[5] Keatslab cited 2007 february available from URL http://www.keatslab.org/myeloma-cell-lines

[6] Kristin matt cited 2007 february available from URL https://www.ncbi.nlm.nih.gov/pmc/articles/PMC4701225/

[7] Steven clay cited 2007 february available from URL https://link.springer.com/chapter/10.1007/0-306-46877-8_4

[8] Cancer gov cited 2006 february available from URL https://www.cancer.gov/types/myeloma/patient/myeloma-treatment-pdq

[9] Protien atlas cited 2006 february available from URL https://www.proteinatlas.org/learn/cellines

[10] Gary M cited 2006 february available from URL https://www.researchgate.net/publication/276370694_Additive_manufacturing_of_Trabecular_Titanium_orthopedic_implants

[11] Lima corporate cited 2006 february available URL https://www.limacorporate.com/aboutus.html?b=technology

[12] Clinical gov cited from 2007 february available from URL https://www.patientresource.com/Multiple_Myeloma_Overview.aspx

[13] Webmd cited 2007 february available from URL https://www.webmd.com/cancer/myeloma-lymphoma-leukemia#1

[14] Mibioresearch cited from 2008 february available from URL https://www.mibioresearch.com/knowledge-center/mm-1s-a-model-for-multiple-myeloma/

[15] Mayoclinic cited 2007 february available from URL https://www.mayoclinic.org/diseases-conditions/multiple-myeloma/symptoms-causes/syc-20353378