Identification and Analysis of Blood Group with Digital Microscope Using Image Processing

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Abstract. Blood group identification is an essential examination for transfusion and also for lot of health check procedures. Conventional micro plate system is painstaking. In this study, an automatic moving conveyor belt setup was developed to assist the diagnosis procedure. Blood group identification is done based on the images acquired through light microscopes. A blood distribution on polystyrene coated bio paper and the captured image data has been analysed using Image Acquisition software. The image morphological patterns were analysed to obtain the identification blood group by capturing its microstructure. At end of each test, based on the clumping and its image morphology of the corresponding colour coding was analysed to identify the blood groups. The focus on the present study is to investigate the chance of quick and precise, sensitivity and concurrent identification of blood group will weigh up its usefulness in the routine use.

Keywords: Blood group identification, Image processing, Automatic Machine

1. Introduction

Blood, fluid is an essential one to all life and it ships the nutrients and oxygen to human cells [1]. In addition, it also ropes the body heat & pH value, immunological operation [1, 2]. Blood component is alienated into two set they are cells and plasma. It contains red cells (RBC), leucocytes and platelets. The first one, RBC is the chief oxygen transporter, secondly the colourless leucocytes are concerned to immunity system and lastly, the platelets are tiny cells which are capable of forming clots to stop continuous bleeding. Blood plasma is the medium which ships hematopoietic cells, alimentary and various hormones to the needy cells. When exsanguinations happen then the transfusion is much crucial. Blood excretion is an alternative solution for the mislaid blood by saline. However, the RBC has to be bringing back for transfusions with suitable practice. Ahead of performing a secured blood transfusion, certain pre-transfusion tests must be undertaken, namely [2, 4]; carried out in test tube, plate, micro-plates, or gel separation [2-4].

The test tube and plate methods are results in a reduced amount of accuracy than the remaining two tests. But they are cheaper and superficial. Micro-plate or gel separation test is the powerful test for blood typing and it is mandatory for secure blood transfusions. Further, it is important to ensure that
the selected blood type is suitable for the receiver [5-12]. During emergency, the adequate time is unavailable to do blood typing so they are choosing blood type O negative (universal donor) [1-3]. Sometimes, this may result into critical issues for the victim. It is imperative to computerize the blood typing [5-12]. The precision of blood typing is crucial and it can elude severe troubles in transfusions. The direct and reverse tests are in practice. In direct test, antigens presence is examined. In the other test the measurement of antibodies is done. Nowadays, Blood typing is done in either manual or automated [13,14].

In manual testing, the results are available in time. However, the human assistance is much needed to conduct the test. Based on ocular inspection, the agglutinated non-agglutinated samples are identified and typing is done. Therefore, the test result is depending on the examiner who involved in the process. So, there may be chance for mistyping [13]. In automation, such human dependency is ignored. Therefore, there are fewer chances for wrong typing [21-22]. Though it is having merit they are slow, high cost and the devices are large in dimensions. Here, the blood is assorted with reagents in order to find the agglutinations. In market, numerous apparatus are available which identifies typing automatically [12-14]. Groupamatic, Auto-Grouper, Olympus PK 7200, Ortho AutoVue Innova System, Techno Twin Station and Immucor Galileo. But till now, no system conveys the result accessible in time for emergency condition [15-19].

While the microscopy method has fine sensitivity and authorize type of detection by image differentiation and detection and counting process is highly precise. Dissimilar cells in digital microscope images can be separated by a spatial investigation and intensity details of the image. There is a speedy and simple way of retrieving an set of images for potential indication as with a automated method. Thus the novel system proposed in this paper, automatically execute the blood type determination process. Hence it can eradicate human mistake in an undersized period. Further, it is suitable during abnormal state. In slide test, the developed software does image processing techniques to identify blood type. The test results are captured by a digital microscope which has a colour image poised of quad tasters of blood & reagent. Such image is considered as an input to image acquisition software. This method intends to create an unique model which is suitable to carry out necessary pre-transfusion analysis for a safe and sound blood transfusion automatically.

2. Experimental Details
The blood of the patient is taken in a slide to respond with the well-known antibodies A, B & D followed agglutination response was recorded. Blood was poured on polystyrene coated bio paper.

Figure 1. (a) Blood sample on polystyrene coated bio paper (b) Blood group testing slide with different colour marked on its bottom for colour coding.
The polystyrene coated bio paper can easily paste and remove from the bottom glass plate as shown in figure 1(a). The bottom of each blood specimen the colour was marked with different colouring agent figure 1(b) for avoiding manual error.

The design of automatic machine for blood group identification as shown in figure 2. The conveyor belt was connected with motor and it operated horizontally. The test slide move on the conveyor belt when entered in to the digital microscope place it on automatically and the image will be scanned. Digital microscopy is highly sensible with range of 50 X (model name BW908/BW908C) is fixed vertically, where the image of the blood sample captured. The process time for analysis of multi plate (maximum 4 plates at the same time) was 30 sec. The captured image data was transferred in to computer where the image has been analysed by the combined system with IMAQ Vision software and image processing techniques. At end of the each test the based on the clumping and its image morphology of the corresponding colour coding as a result of the blood groups.

![Figure 2. Image of automatic machine for blood identification](image)

3. Result and Discussions

If there is a presence of antigen in blood cell related to the counteragent, it results in amalgamation or clustering. When the blood amalgamates by way of anti-A antibody, then it is A type. Similarly when amalgamation by means of anti-B, then it is B type. Conversely if amalgamation is observed among both anti-A and -B then it is AB and no amalgamation reported as O type. In addition, if amalgamation happens through the f anti-RhD antibody, it is reported as positive and otherwise negative. Then, the features such as textural and colour features are extracted and stored in the database. Figure 3. Shows that an image of the digital microscope on blood clumping image capturing and its magnification.
Figure 3. Image of the digital microscope on blood clumping image capturing and its magnification.

Figure 4. Images of blood groups on adding antigens.

The results of blood groups as shown in figure 4 and scattering and non-scattering component was cleared from the above figure. From above image of the blood scattering indicates the reaction between antigens on corresponding to the blood groups. Microstructure and the size precision from the image indicate it’s one of the excellent diagnostic tool for measurement of the blood types. Similar type of agglutination results was explained by Yaw-Jen Chang et al. [20].
Figure 5. Scattered image of O negative Reagent of (a) anti-A (b) anti-B (c) Anti-AB and (d) anti-D.

Result of O negative blood group is presented in above figure 5. It clearly shows the amalgamation takes place only in sample d and not in samples a, b and c. It confirms the nonappearance of antigens AB in the analysed blood sample. Further, the amalgamation is occurred by means of anti-D reagent. Hence, it is proved the existence of antigens Rh in the analysed blood sample. So the results of the above work can be reported as O negative blood type.

4. Conclusion
The above experiment and its results give an effective way of blood type detection and the blood scattering image automatically enable the types of blood groups. During emergency, such way of blood type detection is highly usable. It also helps the admin to choose well-suited blood for transfusion, avoiding feasible blood incompatibilities. In future, it can be scaled down to make it handy.

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