Increased Productivity of Cytogenetic Technologists Due to Implementation of the ASI’s 81 Slide Loader and Metaphase Finder.

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Abstract

In the current medical environment, productivity coupled with accuracy is paramount in providing good patient care. Automated metaphase finder significantly reduces time to ascertain analyzable metaphases, competing with traditional methods based on microscopic analysis. The 81 Slide Loader and Metaphase Finder (MF) of Applied Spectral Imaging (ASI) run continuously, providing a gallery of stored digital metaphase images ready for analysis. Metaphase data, in the form of complete bone marrow or leukemia bone marrow cases (10 cells per sample) per day, was averaged over three months, employing conventional microscopic analysis. The MF was then introduced to our laboratory, enhancing the resolution of banded chromosome analysis. The MF was introduced to our laboratory, enhancing the resolution of banded chromosome analysis. Technologists' productivity was re-measured in the following three months using the same criteria as for microscopic analysis.

Methods

Eleven technologists, from our laboratory, with a wide range of experience, participated in this study. Their productivity, in the form of complete bone marrow and leukemia blood sample cases (10 cells per sample) per day, was averaged over three months, employing conventional microscopic analysis. The MF was then implemented in our laboratory. Slides were prepared in the same way as for conventional microscopic analysis. The MF captures a predetermined number of images for each slide and stores the images. The eleven technologists accessed metaphase images from their desktop computers, which are linked to the MF's stored images. Technologists' productivity was re-measured in the following three months using the same criteria as for microscopic analysis.

Results

Comparison of Productivity in Our Laboratory Using Microscopic and Metaphase Finder Methods

The daily average completed half cases by individual technologists.

Graph 1.

The daily average completed half cases by individual technologists.

Graph 2.

Individual Productivity Increase (%) by Experience Groups

Technologists with 1-4 years of experience increased their productivity by 62.2% per day, those with 5-9 years of experience increased by 33.8% per day, and technologists with 10+ years of experience increased by 26.7% per day.

Graph 3.

Productivity Increase (%) by Experience Groups

The daily average completed half cases by individual technologists.

Graph 4.

Percent increase in productivity of the individual technologists.

Introduction

Providing superior patient care requires a strong mixture of accuracy and turnaround time. Modern technology allows cytogenetic laboratories to improve accuracy by increasing resolution, and maximize turnaround time by decreasing sample processing time. As early as 1964, in an effort to improve productivity, the idea of automated karyotyping machines arose. In 2008, Philippa mentions an automated metaphase locating and karyotyping system built by The National Aeronautics and Space Administration (NASA) in 1976. However, in 1991, 27 years after the idea of automated karyotyping arose, Korhof and Caniisters detailed the clinical effectiveness of commercially available systems and concluded that automated karyotyping remains a highly interactive process requiring improvement. The attention then shifted to semi-automated systems and since then there has been a continuous evolution of metaphase finders, improving the resolution of banded chromosomes. We studied the effects of such semi-automation on technologists' productivity by implementing an 81 Slide Loader and Metaphase Finder (MF) into our cytogenetic laboratory.

Conclusion

Our data indicates that all our technologists, separated into three groups by experience, significantly increased their productivity when using the MF. Furthermore, all of the eleven technologists individually increased their productivity, leading to an overall productivity increase (39.6%) in our laboratory. An inverse relationship exists whereby technologists with lesser experience have a greater increase in productivity, and vice versa. Since more experienced technologists spend less time searching for metaphases, their productivity was increased by a smaller percentage when the MF eliminated this part of the analysis. In addition, more experienced technologists analyze more complex cases, and therefore spend less time preparing metaphases and more time preparing complex karyotypes for supervisor review. The gallery of images generated by the MF also helped our supervisors and directors to review cases more efficiently, improving their productivity as well. The stored digital images can be annotated and shared among users on a network, offering greater flexibility in utilization of the metaphase images for diagnosis. Furthermore, these images can be enlarged and enhanced by adjusting features such as zoom, contrast, and sharpness, allowing for more accurate analysis. In conclusion, the use of automated MFs in laboratories increases productivity, efficiency, and accuracy, giving the laboratory a potential competitive edge in precision, demand for speedy results, and turnaround time.

References