Body Fluid Cell Differentiation: A Comparison Between CellaVision DI-60 and Manual Microscopy in Pleural and Ascitic Fluids

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Introduction

Body fluid (BF) analysis is essential for the diagnosis and clinical decisions of numerous diseases. Cell differentiation by manual microscopy is labor-intensive, time-consuming, and highly dependent on the expertise of laboratory technicians. Digital microscopy cell differentiation may represent an alternative to conventional manual microscopy with the potential of reducing the time of analysis, allowing images archiving (particularly useful as a teaching tool) and remote access (in centers that lack qualified in-situ personnel). In addition, its incorporation into the laboratory workflow can help automate and standardize processes.

The aim of this study was to compare the performance of the CellaVision DI-60 system to conventional manual microscopy for BF cell differentiation.

Methods

We conducted a prospective study with BF samples (pleural and ascitic) received to our Emergency Laboratory. Cytocentrifuge slides were prepared with a Cytospin4 (Thermo-Scientific) and May-Grünwald Giemsa stain. Manual cell differentiation and morphological assessment of BF samples were performed by two independent experienced laboratory technologists. A third experienced observer classified cells with CellaVision DI-60 system v.7.0.1 (CellaVision, Lund, Sweden).

Cells were classified into the following categories: neutrophils, lymphocytes, monocytes/macrophages and mesothelial cells.

Bland and Altman analyses were conducted for all cell categories. Statistical analyses were performed using R (version 4.5.2).

Results

34 BF samples were analyzed: 18 ascitic, 16 pleural. Three BF were excluded: one due to the presence of abundant red blood cells, one for the presence of clusters of extrahematological cells and one due to an improper staining.

The average number of cells analyzed by CellaVision DI-60 was 101 cells [77-115]. Each independent observer analyzed 100 cells.

Bland–Altman analysis demonstrated good agreement between experimented observers and CellaVision (bias<10%). Better agreement was observed for neutrophils and mesothelial cells, with minimal bias and relatively homogeneous dispersion. In contrast, lymphocytes showed negative bias (manual count lower than Cellavision) and monocytes/macrophages a positive bias (manual count higher than Cellavision) but always <10%. Results are summarized in **Table 1** and **Figure 1**.

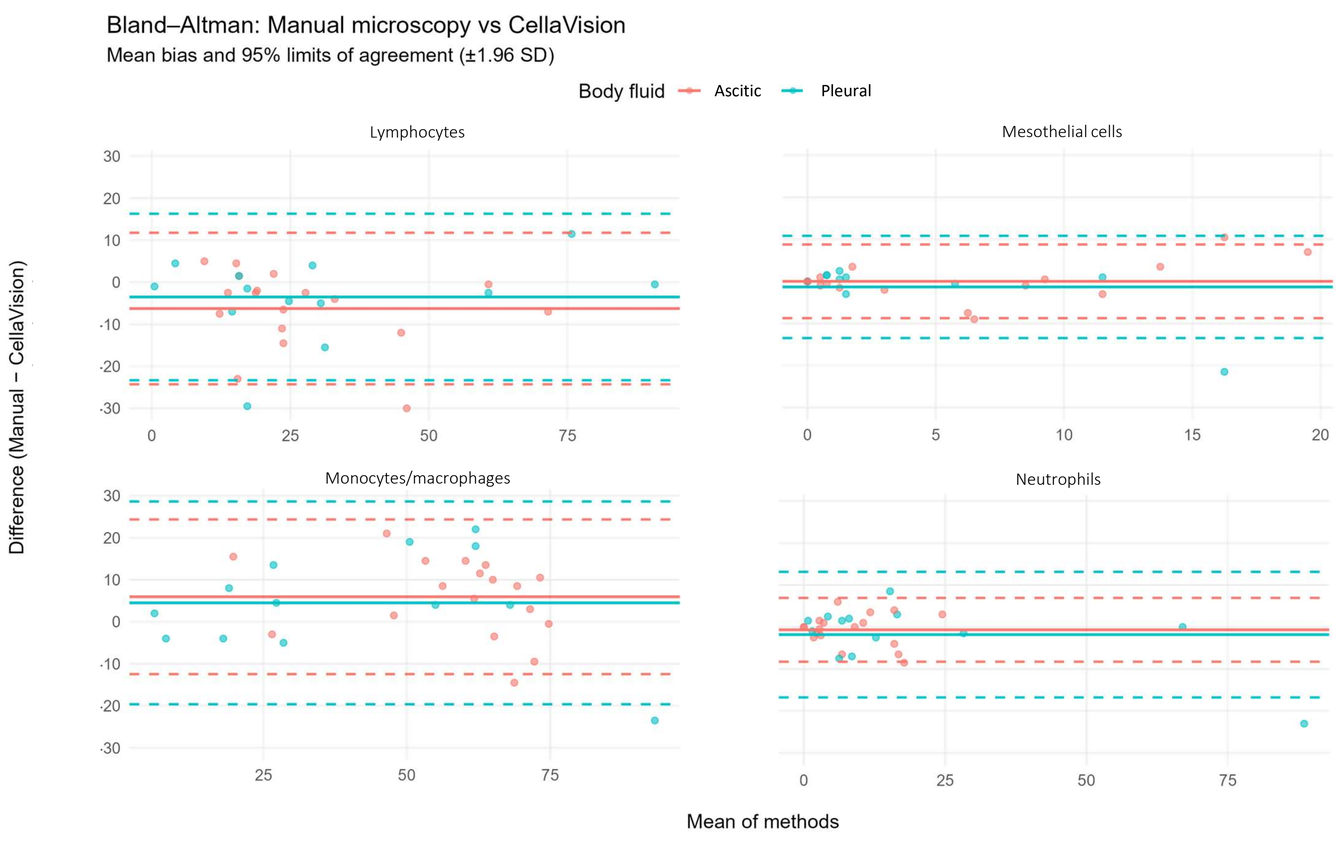

Figure 1 Bland-Altman plots. Comparison of the four part differentation between microscopy and Cellavision DI-60

BF Type	Cell Type	N	Bias	SD of differences	Lower LoA	Upper LoA
All BF	Lymphocytes	31	-5,10	9,53	-23,77	13,57
	Mesothelial cells	31	-0,53	5,21	-10,75	9,69
	Monocytes/ macrophages	31	5,34	10,54	-15,32	25,99
	Neutrophils	31	-1,15	5,66	-12,24	9,95
Ascitic	Lymphocytes	18	-6,25	9,20	-24,28	11,78
	Mesothelial	18	0,03	4,47	-8,73	8,79
	Monocytes/ macrophages	18	5,94	9,39	-12,46	24,35
	Neutrophils	18	-0,67	3,87	-8,26	6,92
Pleural	Lymphocytes	13	-3,50	10,11	-23,31	16,31
	Mesothelial	13	-1,31	6,21	-13,47	10,86
	Monocytes/ma-crophages	13	4,50	12,31	-19,62	28,62
	Neutrophils	13	-1,81	7,62	-16,75	13,13

Table 1 Bland–Altman agreement between observers and CellaVision-DI60 (*LoA: limits of agreement*)

Conclusions

CellaVision DI-60 with post-analysis classification may be an alternative to differentiation by optical microscopy, especially for uncomplicated samples. Some technical issues regarding quality of samples or during slides preparation may interfere with the analysis of samples with this tool.

The main limitations of these study are the limited sample size, the absence of malignant samples and the absence of other body fluid types. Manual microscopy may still be necessary for the review of malignant samples or those with greater number of cells or complexity.

Further studies with larger samples and different fluid subtypes are needed for more robust results.