Original Article

AN ASSESSMENT OF THE ACCURACY OF VISUAL DIAGNOSIS OF MECONIUM-STAINED AMNIOTIC FLUID

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ABSTRACT:

Objective: The assessment of meconium content in the amniotic fluid depends on visual observation by clinicians at the bedside. The aim of the present study was to compare visual evaluation of meconium-stained amniotic fluid with spectrophotometer evaluation.

Study Design: Ten gram of meconium was added to 100 ml of amniotic fluid and mixed. The solution was serially two-fold diluted with amniotic fluid. The serially diluted tubes' absorbance spectrum was measured at 420 nm and thus a standard scale was established. Ninetyfive samples of meconium-stained amniotic fluid were collected from labouring women and the grade of meconium was determined visually at the bedside. The samples' absorbance spectrum was measured at 420 nm and recorded. Spectrophotometer was considered gold standard and the ranges of optical density in the standard scale was used to test the accuracy of visual categorization of the samples. In the statistical analysis chi-square test was used and significance was $p<0.05$.

Results: The accuracy rate of visual diagnosis of meconium-stained amniotic fluid were found as statistically significant (accuracy rate=54.74%, $p<0.001$). Visual evaluation was correct in 19.4% of thin, 53.1% of moderate & 90.6% of thick meconium samples when examined with spectrophotometer.

Conclusion: Visually diagnosed thin meconium can be moderate or thick meconium when examined objectively. The visual diagnosis at bedside is not always reliable and should be replaced with an objective method like spectrophotometery.

KEY WORDS: Meconium; amniotic fluid; spectrophotometer

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INTRODUCTION

The clinical importance of meconium staining of the amniotic fluid is controversial. However, the literature is replete with reports citing meconium detected during labor as a risk factor for adverse perinatal outcome. Thick meconium is considered a more omnious sign than is thin meconium. For clinicians, it is important to accuretly define the type of meconium present. The assessment of meconium content entirely depends on the subjective observation by clinicians[1]: thin (light) meconium-only discoloration of the amniotic fluid; moderate meconium- particulate suspension present; and thick meconium- pea soup viscosity and appearance. Spectrophotometer has been proposed as a reliable alternative[2]. The present study was to test the reliability of

visual categorization of amniotic fluid staining viz a viz spectrophotometer.

PATIENTS AND METHODS

Establishment of a standard scale

Informed and signed consent were obtained from all the patients included in the study. Amniotic fluid was collected after artificial rupture of the membranes from the normal pregnant women in labour. Ten gram of meconium from healthy neonates was added to 100 mL of amniotic fluid and mixed thoroughly. The solution was serially two-fold diluted in amniotic fluid to establish a standard scale. The serially diluted tubes were numbered (1 to 10).[2] The absorption spectrum of each tube, after centrifugation (700 g, 15 min) was recorded at 420 nm, on a spectrophotometer (Sclavo, Unifast 2 analyzer). The absorption spectrum of the last tube (no. 10) could not be read due to its high opacity (optical density >2). By using the optical density of the tubes a standard scale was established. Meconium content of each tube was calculated by the same method used by Park et al.[3] previously. The numbered tubes were categorized according to their meconium content. A meconium content of less than 12.5 mg/ml was considered as thin, 12.5-49.9 mg/ml was considered moderate and 50-100 mg/ml was considered as thick meconium. Table-I shows the optical density of the numbered tubes of the standard scale at 420 nm and meconium content of each tube.

Tests for objectivity and reliability of visual categorization of meconium consistency

Samples of amniotic fluid were collected after spontaneous or artificial rupture of the membranes during labour from 95 women with meconium-stained amniotic fluid. Blood stained samples were discarded. Four attending obstetricians equally experienced determined the grade of meconium by visual examination at the bedside. All samples were presented on a sanitory towel and the categorization was done in the group by the same four obstetricians who represented a specific level of experience. A consensus was reached. Amniotic fluid was considered to have thick meconium only if the fluid was viscous, tenacious, and opaque and contained large amounts of particulate material (pea soup meconium). Fluid that appeared to be normal except for greenish or yellowish coloring was deemed thin meconium, and thicker, darker fluid was labelled moderate meconium. Immediately after visual determination of consistency, the samples were centrifuged (700 g, 15 min) and examined. The absorption spectrum at 420 nm and visual categorization (thin, moderate, thick) of each sample, with meconium-stained amniotic fluid obtained from laboring women, was recorded. Spectrophotometer was considered gold standard and the ranges of optical density in the standard scale was used to test the accuracy of visual categorization of the samples.

The statistical analyses were done by the statistical computer software SPSS, version 10.0. In the statistical analyses chi-square test was used and a *p*-value of <0.05 was considered to indicate a statistically significant result.

RESULTS

Visually, 31 of the samples were categorized as thin, 32 were categorized as moderate and another 32 were categorized as thick meconium. When the accuracy of the visual evalu-

Table-I: The standard scale

Tube No.	*Optical Density (at 420 nm)*	*Meconium Content(mg/ml)*
1	0.19	0.00
2	0.25	0.39*
3	0.29	0.78*
4	0.41	1.56*
5	0.65	3.13*
6	0.91	6.25*
7	1.12	12.5**
8	1.42	25.0**
9	1.91	50.0***
10	>2	100***

*thin, **moderate, ***thick meconium

Table-II: Classification of the visually categorized samples according to the standard scale

	Categorization according to spectrophotometer (optic density ranges)			
	Thin (0.30-0.91)	*Moderate (0.92-1.42)*	*Thick (1.43-1.99 or>2)*	*Total*
Visually thin n(%)	6 (19.4%)	17 (54.8%)	8 (25.8%)	31 (100)
Visually moderate n(%)	-	17 (53.1%)	15 (46.9%)	32 (100)
Visually thick n(%)	-	3 (9.4%)	29 (90.6%)	32 (100)
Total n(%)	6 (6.3%)	37 (38.9%)	52 (54.7%)	95 (100)

ation of the samples were tested with spectrophotomer, the accuracy rate was found as 54.74% (52/95) which was statistically significant ($p<0.001$, $x^2=35.87$). Among the 31 visually categorized thin meconium samples, the absorption spectrum of only 19.4% (6/31) corresponded to the optic density ranges of the thin meconium in the standard scale. 53.1% (17/32) of the samples, which were categorized as moderate visually, corresponded to the absorption spectrum of moderate meconium in the standard scale. Besides, 90.6% (29/32) of visually categorized thick meconium samples corresponded to the optic density ranges of thick meconium in the standard scale. However, among the 31 visually categorized thin meconium samples, 8 (25.8%) were found as thick meconium when tested with spectrophotometer. Table-II shows the classification of visually categorized samples according to optic density measurements.

DISCUSSION

In routine practice, the categorization of the meconium-stained amniotic fluid is done visually at the bedside as “thin”, “moderate” or “thick” meconium.[2,4] The proposed objective methods, such as spectrophotometer and meconium-crit are not practical in routine as expert technicians and instruments are required. Mecometer was the first objective method developed for clinical use by Park et al.[3] Mecometer was reported as a simple and portable method not requiring any instruments for the objective assessment of meconium content in amniotic fluid. This study was planned as there has been no reports testing the reliability of the visual diagnosis of meconium consistency which is still in use in clinic. In the first step of this study which is the establishment of the standard scale, we used the same method with mecometer planned by Park et al.[3] previously. It was found by Park et al.[3] that the optical density was linearly correlated with meconium content. In the reference of this data, we used the standard scale in examining visual categorization of meconium-stained amniotic fluid.

The accuracy of visual diagnosis of meconium-stained amniotic fluid was found as statistically significant (accuracy rate=54.74%, $p<0.001$). However, the accuracy rate of 90.6% in thick meconium and 19.4% in thin meconium samples was challenging. The bedside categorization ‘thick meconium’ in most cases corresponded to the result based on optical density-based categorization, whereas the bedside categorization ‘thin meconium’ was inaccurate as 80% were found to be at least moderate by optical density-based categorization. A more interesting finding was that 25.8% (8/31) of the visually diagnosed thin meconium samples were thick meconium according to spectrophotometer. Although the accuracy of visual diagnosis of meconium-stained amniotic fluid was found as statistically significant, clinical use of visual categorization is not reliable in means of moderate and especially in thin meconium.

It is certain that meconium-stained fluid is predictive for adverse perinatal outcome, however, it may be questionable whether a very precise definition of the degree of meconium will be helpful in handling and conduction of delivery. In all cases of meconium-stained fluid, the fetus should be under close surveillance during labor and measures to reduce the risk of aspiration undertaken. However, most of the studies performed to determine the risk of adverse neonatal outcome associated with meconium-stained amniotic fluid were based on visual categorization of meconium-stained amniotic fluid. After this study, it would be better if the results of the previous studies regarding adverse neonatal outcome associated with meconium stained amniotic fluid are re-evaluated as most of them are based on visual diagnosis of meconium consistency. Another aspect of an exact quantification of meconium-grade in a single sample of fluid may be that the degree of meconium-staining in the initially presented fluid may change during course of delivery so that the initially determined grade may not be totally representative for the entire bulk of fluid. It is still questionable whether we much gain from applying this method in the labor ward.

In conclusion, obstetricians should bear in mind that visually diagnosed thin meconium can be moderate or thick meconium when examined objectively and visual diagnosis at bedside is not always reliable and should be replaced with a new objective method.

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