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Interesting cases in aberrant biochemistry laboratory results

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In this article, three problematic cases in biochemistry determination are presented and discussed. The first case was an indeterminant result for CSF protein due to the concentration threshold or detection limit of the test. The second case was a meaningless determination of bilirubin possibly to due to the external disturbance from an ingested drug. The last case was a meaningless determination of oral glucose tolerance in a pregnant woman due to the pre-analytical cause of hyperemesis. These three cases are good studies of problematic cases in interpretation of aberrant laboratory results.

Key words: *Determination, Indetermination, Meaningless determination.*

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ได้นำเสนอและอภิปรายกรณีศึกษาที่เป็นปัญหาในการตรวจวัดทางชีวเคมีจำนวน 3 กรณี กรณีที่หนึ่งเป็นการไม่สามารถตรวจวัดระดับของโปรตีนในน้ำไขสันหลังได้ เนื่องจากขีดจำกัดหรือระดับวิกฤตของความเข้มข้นต่ำสุดของการตรวจวัดได้ กรณีที่สองเป็นการตรวจวัดบิริลูบินที่ไม่สามารถแปลผลได้โดยเชื่อว่าเนื่องจากการได้รับการรบกวนจากยาที่ผู้ป่วยบริโภค สำหรับกรณีสุดท้ายการตรวจความทนทานต่อการได้รับกลูโคสที่ไม่สามารถแปลผลได้ในผู้ป่วยท้องเนื่องจากปัจจัยก่อนการวิเคราะห์ที่ผู้ป่วยมีอาการคลื่นไส้อาเจียนมาก กรณีทั้งสามที่นำเสนอเป็นตัวอย่างกรณีศึกษาที่ดีสำหรับการแปลผลการตรวจทางวัดทางชีวเคมีในกรณีที่มีปัญหา

Laboratory investigation is an important tool for medicine in the present day. To diagnose and follow up diseases, accurate and precise laboratory analyses are necessary. Presently clinical chemistry laboratory receives a lot of requests per day.

Sometimes, problems with aberrant laboratory results can be found.[1] Examples of these problematic results are partial and total determination problems,[2] indetermination problems and meaningless determination problems. These cases can be interpreted based on the principles of laboratory medicine.

In this article, biochemistry results of three problematic cases in real medical practice were presented and discussed. The theory to explain each indetermination and meaningless determination problem is explained.

Case Reports

Case 1

A 37 year old male patient was admitted to the hospital with a presumptive diagnosis of acute bacterial meningitis. Lumbar puncture was performed on this patient and the CSF was sent to the laboratory for a chemical profile. The amount of the CSF was within the dosage limit of the automated clinical analyzer. The CSF chemical profile was; total glucose= 22 mg/dl and total protein = 0 mg/dl. His attending physician asked the laboratory about the interpretation of the CSF total protein determination. This case was defined as an indetermination.

Case 2

A 34 year old female patient presented to her physician for routine annual check up. She received a serum bilirubin determination in this process. The laboratory results were; total bilirubin = -23 mg/dl and direct bilirubin = - 27 mg/dl. Although changing of the analyzer machine, the concentration and the dilution was performed in order to correct the possible threshold problem, the results remained negative. From further history taking, the patient revealed that she had ingested a locally – made herb regimen daily. This case was defined as a meaningless determination.

Case 3

A 29 year old pregnant patient was referred for suspected gestational diabetes. Her routine urine sugar test was positive, therefore, she received an oral glucose tolerance test (OGTT). The OGTT test revealed; stat glucose level = 81 mg/dl, 1 hour glucose level = 81 mg/dl, 2 hour glucose level = 80 mg/dl and 4 hour glucose = 75 mg/dl. During further history taking, the patient revealed the symptoms of hyperemesis gravidarum. This case was determined as a meaningless determination.

Discussion

Aberrant laboratory results can confuse the attending physician. In this article, five problematic cases in clinical chemistry determination were presented. The first case is an example of indetermination but this problematic case is directly according to the test principle. Similar to the problematic case due to the dilution threshold,[1] Which affects the sample with rather high substance concentration this case is due to the concentration threshold. Indetermination of the sample with rather low substance concentration can also be found. This problem usually found in body fluid chemical analysis such as determination for total protein in CSF and

lipase in pleural fluid. One reason is the analytical methods used are firstly designed for determination of substance in blood sample with higher concentration of chemical substance. It is important that selection of analysis method should be carefully done. The knowledge about the details of used analytical method is necessary for practitioner. Another frequently indetermination of the sample is occurred in lipid profile determination. Sometimes practitioner can find rather low level of low – density lipoprotein (LDL) from calculation method and misguided by the result. The majority of this error is due to the lack of the knowledge about limitation of used method. Therefore , selection for proper diagnostic method [3] in this situation is recommended.

The second case was very interesting, why were the results negative ? In this case, correction for analytical bias by changing the analyzer, and for the threshold problem by changing dilution and concentration were done, but the results were still aberrant. The explanation is possibly due to external disturbance by the ingested drug. Because most chemical substance determinations are based on photometric quantification of the product of a chemical reaction, therefore, external disturbance by other chemicals, such as drug metabolites can occur. [4] Interference to the blank in colorimetric reaction for biochemical analysis is very important. [5] Practitioner of these tests should be aware about this aspect. Knowledge about the detection limit and interference of the analytical method is necessary.

The last case was also a meaningless determination. Why was the pattern of the glucose tolerance test aberrant ?. Considering the urine glucose test result, this patient was likely to have had gestational diabetes. Generally, after a loading dose of glucose, the blood glucose level should be elevated; but in this case the blood glucose level seemed stable. The explanation of this case is due to a pre-analytical error [1] caused by the hyperemetic symptom of the patient. The ingested glucose might have been be vomited before absorption, therefore, the results were as if no loading test had occured. This is one important consideration for performing a glucose tolerance test or other oval loading test during pregnancy. [6] In these cases, such the mentioned tests should be avoided because it provide no usefulness and can be stated as do harm to the patients.

Problems in determination of chemical substances are commonly found. Both indetermination and meaningless determination can lead to errors in interpretation if no careful consideration is made. To cope with problematic cases in biochemical determination, not only interpretation based on the principles of laboratory medicine ,but also good history taking and physical examination are essential.

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