SERUM AMYLASE DURING PREGNANCY, LABOUR AND PUERPERIUM

by

ANIL KUMAR PAL,* D.C.P., M.D., Ph.D.
L. PANHANI,** M.S.
and
B. K. TANEJA,*** M.S.

Introduction

Serum amylase during normal pregnancy has been studied by a few workers that yielded controversial results. The author has been engaged in the study of amylase in serum and various body fluids in various diseases for about 2 years. During early part of this study a few random samples from women in different trimesters revealed significant changes. These results combined with rarity of work on serum amylase during labour and puerperium provided an impetus to continue the study.

Material and Methods

Four hundred and fifty-five women with normal pregnancy aged 16 to 46 years (27.5 ± 4.5) were taken at random from the ward and antenatal clinic during the period from February 1979 to March 1981. Thirty-two cases were in the first trimester who reported for medical termination of pregnancy, 43 in the second trimester, 102 in the third trimester, 34 in the second stage of labour and 289 in puerperium, from day 1 to day 11. All cases had normal delivery. A second sample of serum was tested in the puerperium from 41 full term cases (the first sample having been taken 1-12 days antepartum) and 4 labour cases. Amongst the purely puerperal cases, two serial estimations were done in 28 cases. Thirty non-pregnant females aged 20-30 years with no evidence of any organic disease served as control.

The serum amylase was determined according to Wootten (1964).

Observations

The results are shown in the figures 1 and 2. There was a significant rise in the serum amylase in the first trimester, a further rise in the second trimester followed by a decline in the third trimester but not to the normal level. A second higher peak value was noted in the second stage of labour, the level persisting at nearly the same level upto 48 hours postpartum. Thereafter, a gradual regression was noticed upto 11th day, the last observation day in this study. The level of the enzyme was still above the control level.

Statistically, the p value was less than 0.001 for each trimester and 24 and 48 hours postpartum. Statistical analysis for the remaining puerperal days was not considered essential (Table I).

*Head, Department of Pathology, Base Hospital, Delhi Cantt-110 010.
**Head, Deptt. of Obstetrics and Gynaecology, Base Hospital, Delhi Cantt.
***Specialist in Obstetrics and Gynaecology, Base Hospital, Delhi Cantt.
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TABLE I
Serum Amylase During Pregnancy and Labour (SU/100 ml)

	Range	Mean	SD	p value
Control (30)	80-160	122.66	20.48	—
First trimester (32)	120-200	153.12	24.29	0.001
Second trimester (43)	120-240	163.43	27.05	0.001
Third trimester (102)	100-210	144.80	27.35	0.001
Labour (34)	120-220	185.62	22.60	0.001

Figures within brackets indicate number of patients.
SD—standard deviation.

One woman in full term (non included in the analysis) had serum amylase level of 1320 SU/100 ml, for no obvious cause. The delivery was normal. She did not report for further study.

Discussion

There have been conflicting reports on the concentration of serum amylase during pregnancy viz., normal or almost normal level (Wolgemuth, cited by Burt and McAlister, 1966; Burt and McAlister, 1966), low levels during 8th to 16th week followed by a steady rise but normal level at term (Fitzgerald, 1955) as well as very high levels (Aldercreutz *et al* 1972), the latter did not specify the stage of pregnancy. The results of the present study agrees well with those of Kaiser *et al* (1975) who examined 200 cases and noted a gradual rise through first trimester to a peak level in the second trimester followed by a decline in the third trimester, but the level being still higher than normal.

During the pilot study a few serum samples from early puerperal cases showed values higher than the third trimester level. This led to the study of labour cases who showed the highest enzyme level. The author is not aware of a similar work.

As regards puerperium, Fitzgerald (1955) remarked that an occasional case might show high values. Burt and McAlister (1955) in their study upto 4th puerperal day noted higher enzyme levels than at term. The present study has shown values as high as during labour upto 48 hours postpartum and then a progressive decline but not to the normal level even by the 11th day. Further work with larger number of cases during still later stages of puerperium would be worthwile (Tables II and III).

The mechanism of the altered blood amylase level during pregnancy is yet to be clearly elucidated and appears multifactorial. During pregnancy, complicated changes occur in milieu interior due to various hormonal-metabolic changes there is likely to be a redistribution of the enzyme. Also renal clearance may be a factor (Aldercreutz *et al* 1972). However, major part of the enzyme is cleared by extrarenal mechanism, postulated to be reticuloendothelial system (Salt and Schenker, 1976). Though the pancreas and salivary glands are the main source of amylase, recent studies have shown it to be produced by various organs like proximal duodenal glands, lungs, liver, fallopian tube, endometrium as well as

TABLE II

Serum Amylase During Puerperium (SU/100 ml)

	Range	Mean	SD	p value
Day 1 (127)	160-240	186.45	18.59	0.001
Day 2 (51)	100-240	182.74	27.08	0.001
Day 3 (31)	100-240	177.74	28.02	—
Day 4 (23)	140-220	175.65	20.39	—
Day 5 (9)	160-200	171.11	13.69	—
Day 6 (10)	140-200	168.00	16.00	—
Day 7 (12)	140-200	165.00	14.43	—
Day 8 (6)	140-180	163.33	13.74	—
Day 9 (11)	120-180	154.54	17.24	—
Day 10 (4)	115-160	148.75	19.48	—
Day 11 (5)	115-160	142.00	22.04	—

Figures within brackets indicate number of patients.

TABLE III

Serial Estimation of Serum Amylase: Days and number of cases

	Puerperal day											Total number
	1	2	3	4	5	6	7	8	9	10	11	
Full term	18	8	-	4	2	1	4	-	2	2	-	41
Labour Puerperal	1	2	-	-	1							4
Sample 2 — Sample 1 day												
1 „	-	-	5	8	2	1	2	2	-	-	-	20
2 „	-	-	-	-	-	-	1	2	-	-	2	5
3 „	-	-	-	-	-	-	-	1	-	1	-	2
4 „	-	-	-	-	-	-	-	-	-	1	-	1
Grand Total number	19	10	5	12	5	2	7	5	2	4	2	73

various neoplasms including ovarian cysts (Berk and Fridhandler, 1977). Liver is very susceptible to hormonal influence (Aldercreutz *et al* 1972). Further amylase is required for glycogen synthesis (Janowitz and Dreiling, 1959). Increased rate of glucose utilization depresses the enzyme level, while the

reverse occurs with decreased utilization (Dreiling *et al* 1958). Contribution of fallopian tube and endometrium also should be investigated. Very high blood leves with ruptured ectopic fallopian tube pregnancy have been reported (Kelley and Rochester, 1957; Flege, 1966; Hochberg, 1974). That the placenta is an unlikely source is shown by the raised enzyme level during puerperium.

A second peak during second stage of labour can be attributed to stress response mediated via ACTH-adrenocortical axis (Challis *et al* 1957). Also a precipitous rise of intraabdominal pressure may affect the liver as well as the pancreas by reduction of their blood flow or by inducing injury to a few small pancreatic ducts insufficent to cause acute pancreatitis.

One full term woman with serum amylase level of 1320 SU/100 ml is of special interest. Berke *et al* (1971) reviewed 106 cases of pregnancy pancreatitis including 4 of their own which occurred mostly during last trimester and early puerperium. One postulated mechanism is that of sudden rise of intraabdominal pressure due to enlarged uterus, coughing, sneezing, vomiting and strain at delivery leading to rupture of small pancreatic ducts but this cannot explain the postpartum cases. Joske (1955) noted 6 cases during a few weeks or months following pregnancy none of whom presented at first with any evidence of pancreatitis and suggested the term 'postpartum pancreatitis' to be used for such cases until etiology is known. Fitzgerald (1955) estimated lipase in 50 cases with high or low amylase levels during term or puerperium which did not indicate any evidence of pancreatitis. He considers such pancreatitis may be due to rebound of pancreatic enzymes rather than to a proceeding inflammation of the pancreas. The cause of marked hyperamylaseamia noted by the present author—a level diagnostic of acute pancreatitis remains abscure.

Recent studies of amylase by many procedures like gel chrotography, electrophoresis in various media and isoelectric focussing have revealed various isoenzyme fractions, the latter technique has shown 6 salivary and 8 pancreatic isoamylases (Rosenmund and Kaczmarek, 1976). In a study of 8 cases with high and low amylase levels Kaiser *et al* (1957) have shown P (pancreatic) and S (salivary) type isoamylases distribution as 1:1, 1:3 and 1:1 in 3 successive trimesters respectively indicating a redistribution of the isoamylases during the second trimester with S-type predominating.

The author estimated the heat stable fraction of amylase in all cases and noted a parallel rise along with the total values (to be published). This fraction is attributed almost solely to the liver (Joseph *et al* 1965). Hence the liver contributes to the rise of serum amylase during pregnancy but the rise though constant in almost all cases is small and cannot account for the total rise. Further work with isoenzyme must be done.

Summary

Serum amylase estimation in 445 women in different trimesters of pregnancy, in second stage of labour and in puerperium has shown a progressive rise with two peaks at the second trimester and in labour respectively. In the third trimester the level is still higher than normal. The highest level attained during labour has been maintained upto 48 hours postpartum and thereafter the concentration has progressively declined, though the level has been still higher than normal

even by 11th puerperal day.

One full term woman has shown the highest level of 1320 SU per 100 ml. for no obvious cause.

The complicated mechanism responsible for the altered level of the enzyme has been discussed. The liver, though to a small extent, has been observed to be a contributing organ.

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