Research Paper Anatomy

Histological Development of Bursae Around Human Foetal Shoulder Joint

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ABSTRACT

Shoulder joint is a synovial joint of ball and socket variety. The various components of shoulder joint start developing in early embryonic life and foetal life around 6th to 12th week of development. The present study aims to gain an insight regarding development of various bursae around this joint. Shoulder joints of 32 foetuses collected from areas in and around Jammu were dissected properly and decalcified in Gooding and Stewart's solution. Sections were cut after obtaining blocks by paraffin wax embedding method. Slides were stained using Haematoxylin and Eosin and Masson's trichrome staining and important findings were documented. Bursae are seen as small spaces in the synovial tissue. At 10 weeks subacromial bursa is seen. Bursa subscapularis is seen at about 14 weeks. Subcoracoid bursa is seen at 141/2 weeks. There is progressive increase in amount of fibrous tissue around these bursae. No communication is seen between bursa subscapularis and joint cavity. So by 10 weeks bursae begin to appear in shoulder joint and from very early stages development proceeds to achieve adult characteristics.

KEYWORDS : subacromial bursa, subcoracoid bursa, subscapular bursa

INTRODUCTION:

Shoulder joint is a synovial joint of ball and socket variety. It is a simple joint having only two articulating surfaces; head of humerus and glenoid fossa. The articulating surfaces are reciprocally curved. The articulating bones are joined together by capsular ligament which is lined internally by synovial membrane. Both articulating surfaces are covered by hyaline cartilage. By 6th week of development cartilage models of bones of shoulder joint i.e. scapula and humerus are formed by chondrocytes[1]. When skeletal elements appear, some areas in between do not undergo any change. These interzones persist as future joint cavity[2, 3]. Several bursae are seen around shoulder joint. Most conspicuous ones are bursa subacromialis, bursa subscapularis and Subcoracoid bursa. Bursae develop by progressive splitting of embryonic fibrous tissue of a particular region. Slits appear between the cells and later develop into definite cavities lined by fibroblasts and other connective tissue elements. Bursa subacromialis develops early in 3rd month of intrauterine life, is more rectangular and does not extend relatively as far either anteriorly or posteriorly. The cells lining the bursa are elongated and arranged in direction parallel to long axis of future bursa[4]. Bursa subscapularis develops independent of joint cavity and a communication between two cavities occurs secondarily[5]. In early stages of development cavity of bursa subscapularis usually communicates with joint cavity but at times communication may not occur[6]. Occasionally a bag of synovial membrane comes out through some opening in capsular ligament and acts as a bursa[1]. Subscapularis bursa is regarded as a pouch strongly attached to scapular neck and adjacent parts of joint capsule[7]. Bursa subscapularis and recesses on anterior aspect of shoulder have been classified into four types[8].

Only a few studies related to development of shoulder joint have been devoted to bursae. Some confusion also arises about communication of subscapular bursa with joint cavity. Therefore present study concentrates on development of bursa around shoulder joint.

METHODS:

This study was conducted on 32 foetuses of various gestational ages obtained from 2005 to 2006 in Jammu (India) and areas surrounding it. The foetuses were obtained as products of abortions, still births and hysterotomy procedures. They were preserved in 10% formalin. The crown rump (CR) length of foetuses was measured with Vernier calliper to determine their gestational age as per rule described by Hamilton, Boyd and Mossman[9].

Sex of foetuses was determined and pectoral girdle was separated from trunk. The area was dissected properly and dissected specimens were kept inside tissue capsule. Tissue capsule is a small container having holes in it which allow fixative to enter inside when tissue is placed in it. This prevents loss of specimen during processing. Specimens were fixed by 10% formalin solution to impart firm consistency for period of 48 hours to 1 week – depending upon size of specimen. The specimens were decalcified by placing in Gooding and Stewart's 5% solution[10] for 4-5 days. Bigger specimens were decalcified by treating with 5% nitric acid. The tissue was prepared for sectioning by using paraffin wax embedding method. After trimming paraffin wax block sections of 7 microns thickness were cut with rotary microtome. Both coronal and transverse sections were taken. Sections were transferred to water bath to remove wrinkles. Sections were fixed on slides smeared with drop of Mayer's egg albumin. Then slides were stained with Haematoxylin and Eosin and Masson's trichrome. Slides were examined under light microscope and photographic documentation of important findings was done.

RESULTS:

The foetuses are divided into six groups based on their stage of histological development:

GROUP 1: 53-58 mm CR length (72 – 75 days or 10 – 11 weeks)

The frontal or coronal section of foetus of 10 – 11 weeks shows sub-

acromial bursa deep to acromion as a small area of loosely arranged tissue as compared to immediately surrounding tissue. Some strands could be seen within it (Fig 1). A bursa is seen deep to supraspinatus muscle as depicted in fig 2.

GROUP 2: 75 – 98 mm CR length (86 – 102 days or 12 – 14 weeks)

The frontal section of foetus of 14 weeks shows bursa subscapularis. Under higher magnification bursa is seen to be lined by synovial cells underneath which collagen fibres are present (Fig 3). Frontal section of foetus of $14^{1/2}$ weeks shows Subcoracoid bursa. Subacromial bursa is also seen (Fig 4).

GROUP 3: 110 – 128 mm CR length (110 – 122 days or 15 – $17^{1/2}$ weeks)

The frontal section of foetus of $15^{1/2}$ weeks shows subacromial bursa. Under higher magnification it is seen to be lined by synovial cells. There is increase in amount of fibrous tissue subjacent to the synovial cells. Frontal section of foetus of 16 weeks shows subacromial bursa. It is well developed and is lined by flattened cells towards the surface while those deeper down are irregularly arranged. The tissue in vicinity of subacromial bursa contains number of collagen fibres. Frontal section of foetus of $16^{1/2}$ weeks also shows subacromial and Subcoracoid bursa (Fig 5).

GROUP 4: 132 – 142 mm CR length (124 – 131 days or 18 – $18^{1/2}$ weeks)

Frontal section of foetus of 18 weeks shows subacromial bursa. Its wall is thickened due to greater amount of fibrous tissue which is deposited in its wall (Fig 6).

GROUP 5: 143 – 168 mm CR length (132 – 148 days or 19 – 21 weeks)

Frontal section of foetus of 19 weeks shows subacromial, Subcoracoid and subscapularis bursa. There is progressive increase in thickness of wall of this bursa due to deposition of collagen fibres. There is no communication of subscapularis bursa with the joint cavity.

Subacromial and Subcoracoid bursae are also seen in foetus of 21 weeks of gestational age (Fig 7)

.GROUP 6: 172 to 240 mm CR length (151 -196 days or 22 to 28 weeks In foetus of 22 weeks of gestational age subacromial Subcoracoid and subscapular bursae are seen.

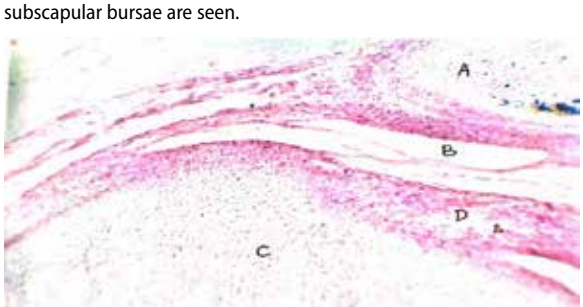

Fig1: Microphotograph of human foetal shoulder joint at 10 weeks gestation showing acromion "A", Subacromial bursa "B", Head of humerus "C" and capsular ligament "D"

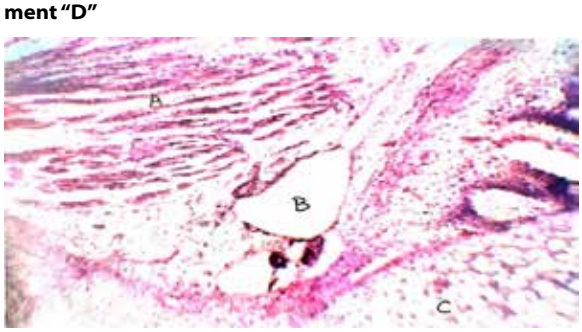

FIG2: Photomicrograph of human foetal shoulder joint at 10 weeks showing supraspinatus "A", Bursa supraspinatus "B" and scapula "C"

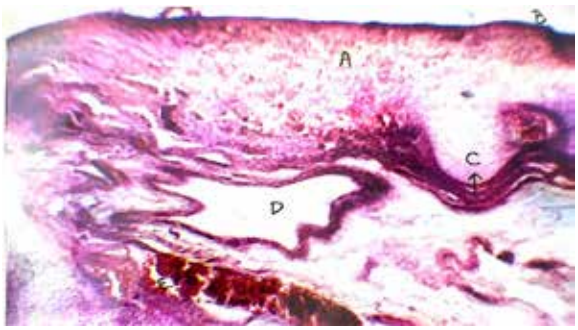

Fig3: Photomicrograph of human foetal shoulder joint at 14 weeks showing Capsular ligament 'A', joint cavity "B", inferior glenohumeral ligament "C", bursa subscapularis "D", blood vessels "E" and neck of scapula "F"

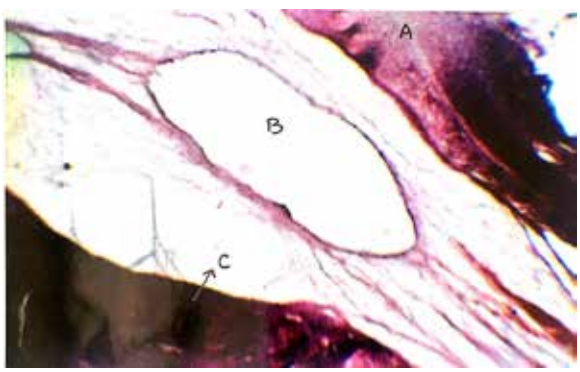

Fig4: Photomicrograph showing of human foetal shoulder joint at 14 ½ weeks showing lateral end of clavicle "A", subacromial bursa "B" and tendon of supraspinatus "C"

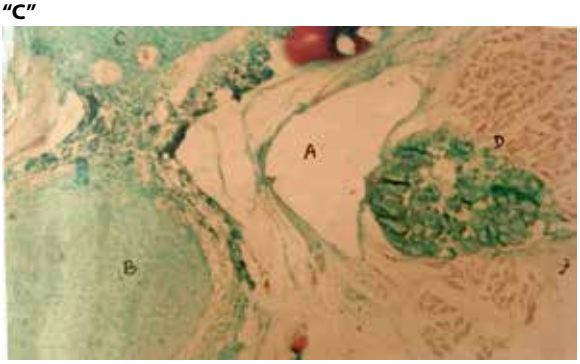

Fig5: Photomicrograph showing of human foetal shoulder joint at 16 1/2 weeks showing Subcoracoid bursa "A", coracoid process "B", glenoid fossa "C" and subscapularis muscle and its tendon "D".

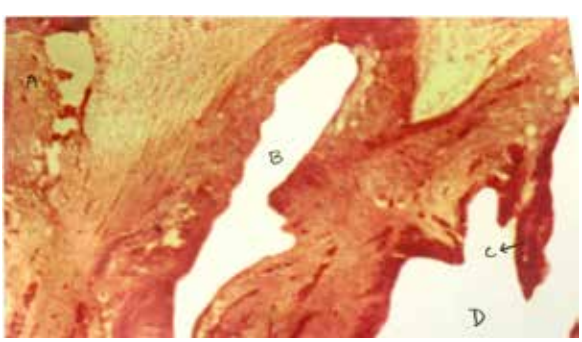

Fig6: Photomicrograph showing of human foetal shoulder joint at 18 weeks showing Acromion "A", subacromial bursa "B", synovial villi "C" and joint cavity "D".

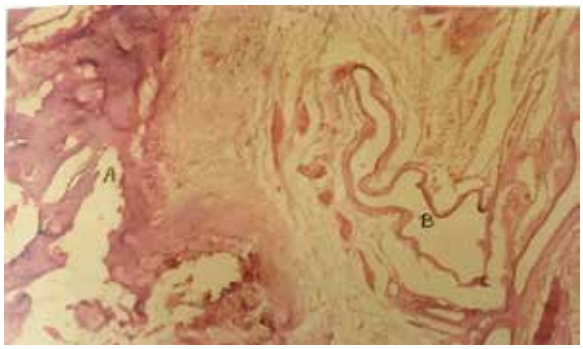

Fig7: Photomicrograph showing of human foetal shoulder joint at 21 weeks showing coracoid process "A" and Subcoracoid bursa "B"

DISCUSSION:

In this work, bursae are seen as small spaces in the synovial tissue. A cavity is regarded as a bursa if it has an inner surface which differs from the surrounding tissue. Spaces lined by synovial cells have been considered as bursae. The lining of these cavities is smooth. At 10 weeks subacromial bursa and bursa supraspinatus are seen. These findings are consistent with those of Black B M[4].The first appearance of bursal cavities is closely correlated with the first appearance of a slit for articular cavity of the shoulder. Our finding is consistent with Black B M[4] but many earlier investigators like Velpean[11] believe that bursae are formed in response to use and they are formed due to friction arising by foetal movements. They are believed to develop as a result of coalescence of pre existing connective tissue spaces. Bursa subscapularis is seen around 14 weeks and Subcoracoid bursa is seen at about 14[1/2] weeks. These findings are in accordance with Gardner. And Gray, D.J.(1953)[1] and Laila,M[12.] No communication has been seen between bursa subscapularis and joint cavity. Our findings are consistent with Gardner, E and Gray, D.J.(1953)[1] but as per Rosenfeld [5] and Simon[6] it communicates with joint cavity.

CONUSICON:

From the present study we infer that just like other components of shoulder joint, bursae develop quite early. Subacromial bursa appears by 10 weeks. Bursa subscapularis appears by 14 weeks and Subcoracoid bursa appears by 141/2 weeks. With the increasing age of foetuses the amount of fibrous tissue underlying the synovial cells increase in thickness due to deposition of more and more collagen fibres.

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