Torsion & Detorsion

Among molluscs, Gastropoda have an asymmetrical body where mantle cavity lies anteriorly, and the shell and the visceral mass coiled spirally and directed posteriorly. Anterior position of mantle cavity in gastropods is due to torsion of the visceral mass during development.

Torsion or twisting is a process that rotates the viscero-pallium anti-clockwise through 180° from its initial position, so that mantle cavity, with its pallial complex, is brought in front of the body, in adult. It occurs during larval development of gastropods.

Site of Torsion:

Actual site of torsion is neck, behind the head-foot, through which oesophagus, rectum, aorta, visceral nerve loop and shell muscles pass. Thus, actual twisting involves the neck tissue and structures within it.

Mechanism of Torsion

Prior to torsion, larva is quite symmetrical, the mantle cavity faces backwards and downwards, alimentary canal is straight and anus opens posteriorly in middle line. A ventral flexure of the body causes looping of alimentary canal and approximation of mouth and anus. Shell and visceral mass, originally saucer-shaped, become first cone-shaped and later spirally coiled. Shell lies dorsally and forms a coil on the anterior side. Such a shell is called exogastric. Ventral flexure is followed by a lateral (torsion, so that dorsal or exogastric shell becomes ventral or endogastric). Lateral torsion is probably due to arrest of growth on one side and active extension on the other. Generally, growth of the right side becomes retarded so that mantle cavity and pallial complex

gradually pass round to right side, and so to the anterior side, on account of greater growth of the visceral sac towards the left. But the whole process completes in 2 or 3 minutes in Acmaea, so that it cannot be regarded due to differential growth. In contrast, it is due to muscular contractions.

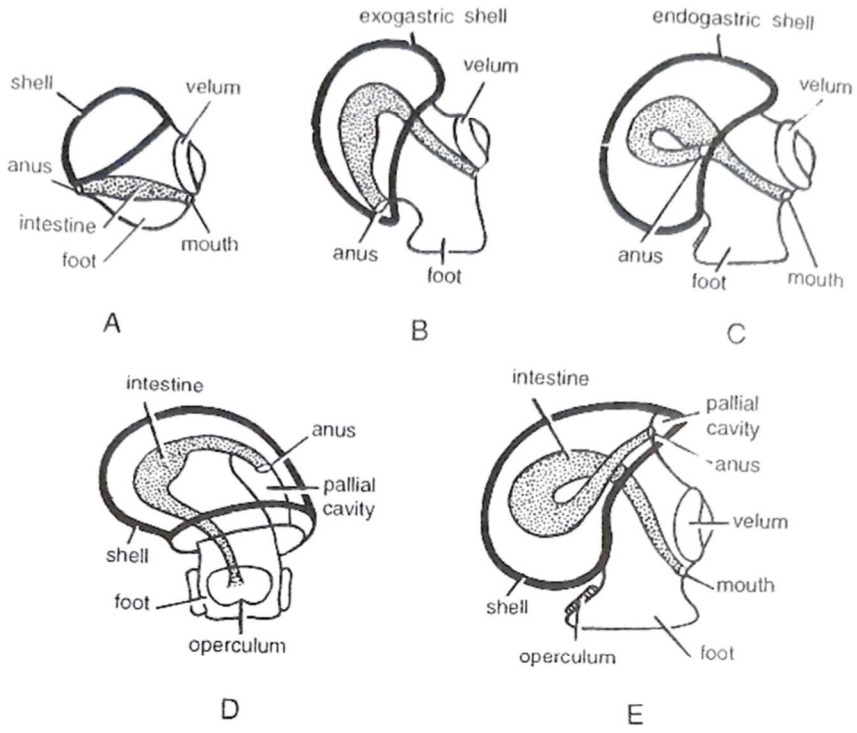

Fig. 5 successsive stages in the development of gastropod showing torsion

A. Pretorsional stage in larval stage

B. Larva with ventral flexure and an exogastric shell in lateral view

C. Stage 90° of lateral anticlockwise torsion, showing shell ecoming exogastric,mantle cavity and anus move to right side

D. 90° view in posterior view

E. Adult with complete or 180° torsion in lateral view

Actual mechanism of torsion is supposed to the asymmetrical position and pull of the larval retractor muscles running from the velar lobes to the shell. They are present only on the right side, there being no related muscles on the left side. Contraction of larval retractor muscles brings about the rotation or torsion. Only narrow neck of the larva is actually twisted. Consequently, everything between the head and anus undergoes an anticlockwise rotation or torsion through an angle of 180° around a vertical axis passing in a dorso-ventral direction.

Thomson (1958) after careful study recognises five ways in which torsion can be brought about:

(1) Complete or 180° rotation, achieved by muscles contraction alone, is known only for Acmaea (Archaeogastropoda).

(2) 180" rotation achieved in two stages, first 90° movement by contraction of larval retractor muscles and later a slower 90° rotation by differential growth. It is the commonest mechanism which is known today. e.g.. *Haliotes, Patella*

(3) 180° rotation by differential growth processes alone, e.g.. *Vivipara.*

(4) Rotation by differential growth processes, with anus coming to a position appropriate to adult state. e.g., *Aplysia.*

(5) Torsion no longer recognisable as a movement of viscera-pallium, the organs in post-torsional position from their first appearance. e.g., *Adalaria.*