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An attempt to design ready-to-use Thomas splint for ruminants

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Even in the twentieth century when science and technology were at their peak, veterinarians are fabricating Thomas splint for large animals based on own experiences. As preparation of Thomas splint for large animals demands much labour and time, most of the veterinarians do not go for constructing the Thomas splint, which devoids the animal of appropriate treatment. Till date ready-to-use Thomas splint is not available for large animals due to lack of proper knowledge and information on the standard measurements for fabrication of the ring and length of extension splint. Hence, an attempt was made to provide standardized information for the measurement of circumference of the ring and splint length for the fabrication of ready-to-use Thomas splint for ruminants.

In the present study 144 ruminants of bovine (Fig. 1), caprine and ovine species of all possible age groups were included. The animals were divided into 24 groups of 6 animals each as per their height, keeping a difference of 2 inches between each consecutive group. The minimum and maximum heights of ruminants in this experiment were 10 inches and 57 inches respectively. The average of the lower and upper limit in height of each group was taken during regression analysis. Measurements of various biometrical parameters like height of the animal, length of humerus or femur, circumference around the axilla and groin and length of the splints from the centre of ring were recorded.

Height of the animals, vertical distance from the ground to the highest point of wither, was recorded in its standing position. Measurements were taken by a special graduated wooden bar having sliding arrangement and marked in inches (Fig 2).

Length of the humerus was measured by taking the distance from the lateral tuberosity at the proximal end to the lateral epicondyle at the distal end (Fig. 3). Similarly, the length of the femur was measured by taking the distance from the trochanter major on the proximal end to the lateral epicondyle on the distal end of the thigh region (Fig. 4) (Sisson and Grossman 1953). The mean value of 6 animals of each group was recorded in inches.

For the measurement of circumference, of the proposed ring around the axilla, a G.I. wire of 4 mm thickness, moulded in a circular form was used as it could easily be coiled or straightened during measurement. For the fore limb, the circular form was kept in close contact with the axilla. The upper arc of the form remained over the tuber spine of scapula and the lower arc of the circular form was kept in close contact with the axilla. The anterior arc of the form was kept in front of the shoulder joint and the posterior arc was kept behind the elbow joint (Fig. 5). Similarly in the hind limb, the upper arc of the circular form was kept just below the ilium, the lower arc kept close to the groin, the anterior arc was kept in front of the stifle joint and the posterior arc was kept in front of the tuber ischii (Fig. 6). After assessing the size of ring with the GI wire, the wire length was measured and recorded (Fig. 7). The mean value of the circumference at axilla and groin and its diameter of 6 animals of each group were recorded in inches. The measurements were rechecked against the model frames of the Thomas splint (Fig. 8).The length of the proposed Thomas splint was also recorded with the model frames. Model frame of the Thomas splint was prepared by fixed diameter iron ring and fitted with extension frames. All the measurements are given in Table 1. The land marks showing bone length, height of the animal circumference of the ring are shown in Fig. 9. Pi value is taken as 3.14.

Thomas splint was designed (Fig. 10) in such a manner so that the ring was not be too loose or too tight so as to facilitate good blood supply at the contact points (Stashak 1987). For the estimation of an approximate circumference of the ring around the axilla or groin, the land marks denoted agrees with the statement (Jean and Anderson 2004). A relationship was established between the height of the animal and length of the Thomas splint (measured from the centre of the ring) using regression analysis, which was as follows

Length of the fore limb Thomas splint in inches

$= 2.42 + (0.68 \pm 0.01) \times$ height of the animal in inches

Length of the hind limb Thomas splint in inches

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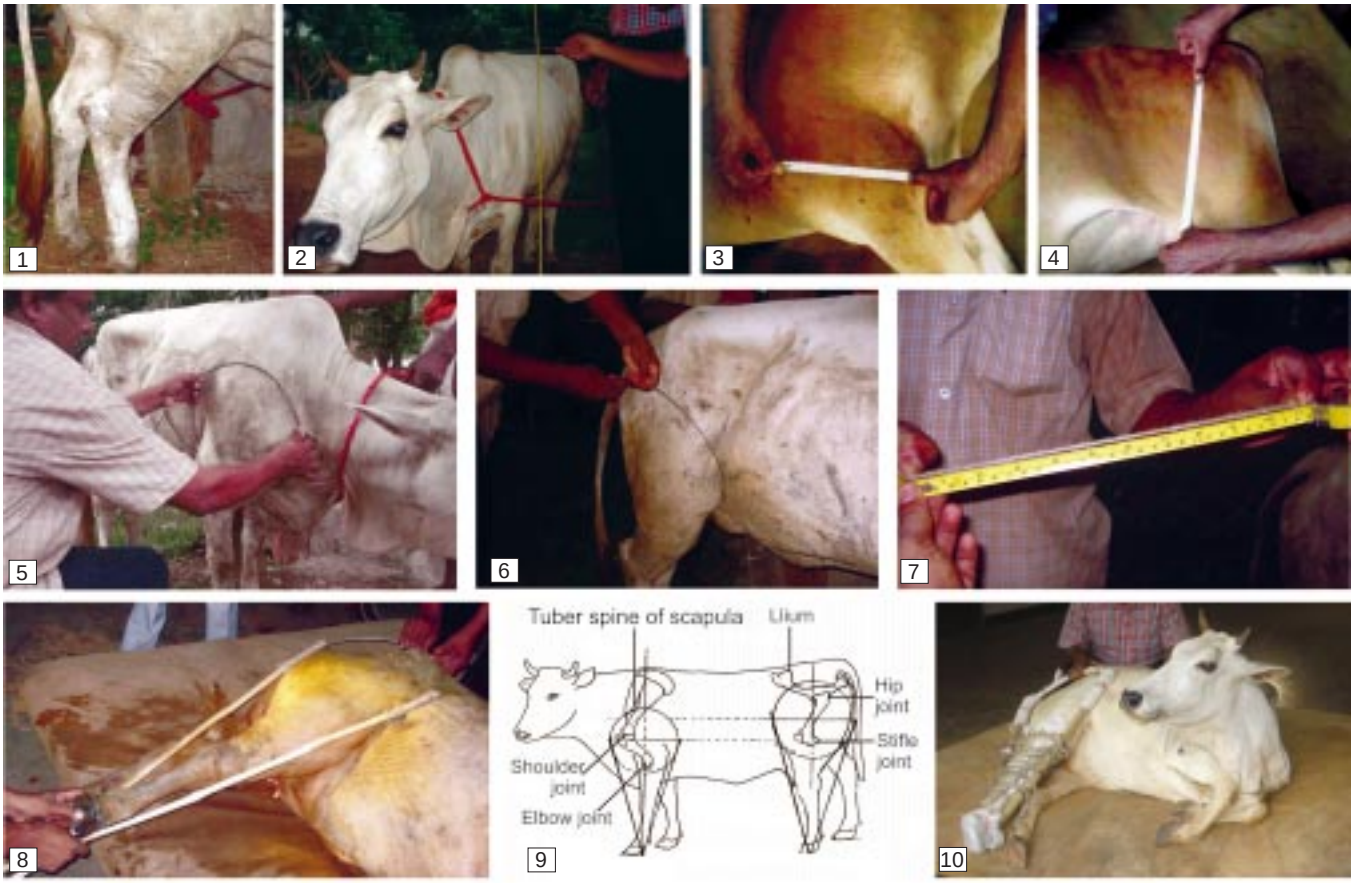
Table 1. Relationship between mean bone length and circumference of the ring and height of the animal and length of the thomas splint

	Forelimb (in inches)					Hindlimb (in inches)						
Height of the animals	Length of humerus	Circumference of the proposed ring around axilla	Circumference of ring/length of humerus	Radius of the ring	Length of the side bar	Length of Thomas splint	Length of femur	Circumference of the proposed ring around groin	Circumference of ring/length of Femur	Radius of the ring	Length of the side bar	Length of Thomas splint
10 – 11	03.00	10.50	3.50	3.34	11.00	10.87	03.50	12.00	3.42	3.82	12.00	11.85
12 – 13	03.41	11.90	3.48	3.79	12.00	11.85	03.91	13.33	3.40	4.24	13.16	12.99
14 – 15	03.91	13.66	3.45	4.35	13.00	12.82	04.41	15.16	3.43	4.83	14.33	14.13
16 – 17	04.25	14.75	3.47	4.70	14.16	13.96	04.83	16.33	3.38	5.20	15.50	15.28
18 – 19	04.75	16.41	3.45	5.23	15.33	15.11	05.50	18.75	3.40	5.97	16.66	16.39
20 – 21	05.33	18.41	3.45	5.86	16.50	16.24	06.00	20.41	3.40	6.50	17.83	17.53
22 – 23	05.75	19.83	3.44	6.31	17.66	17.38	06.58	22.00	3.34	7.01	19.16	18.84
24 – 25	06.16	21.00	3.40	6.69	18.83	18.53	07.00	23.50	3.35	7.48	20.50	20.16
26 – 27	06.50	22.00	3.38	7.01	20.16	19.85	07.50	25.08	3.34	7.99	21.83	21.46
28 – 29	06.83	23.66	3.46	7.53	21.50	21.17	07.91	26.50	3.35	8.44	23.16	22.77
30 – 31	07.25	25.16	3.47	8.01	22.83	22.48	08.25	28.08	3.40	8.94	24.50	24.09
32 – 33	07.83	27.40	3.49	8.73	24.16	23.76	08.83	29.83	3.37	9.50	25.83	25.39
34 – 35	08.25	28.91	3.50	9.21	25.50	25.08	09.41	31.41	3.33	10.00	27.33	26.87
36 – 37	08.75	30.41	3.47	9.68	27.00	26.56	10.00	34.50	3.45	10.99	28.83	28.30
38 – 39	09.41	32.66	3.47	10.40	28.50	28.02	10.91	37.66	3.45	11.99	30.33	29.73
40 – 41	10.25	36.83	3.59	11.73	30.00	29.42	11.66	40.50	3.47	12.90	31.83	31.17
42 – 43	11.00	38.50	3.50	12.26	31.50	30.90	12.41	43.00	3.46	13.69	33.50	32.79
44 – 45	12.00	42.00	3.50	13.37	33.00	32.32	13.41	46.50	3.46	14.81	35.16	34.37
46 – 47	13.00	45.33	3.48	14.44	34.66	33.90	14.41	50.33	3.49	16.03	36.83	35.95
48 – 49	14.00	48.50	3.46	15.44	36.33	35.50	15.50	53.41	3.44	17.01	38.50	37.55
50 – 51	14.83	51.90	3.50	16.53	38.00	37.09	16.33	56.50	3.45	18.00	40.16	39.14
52 – 53	15.66	54.66	3.49	17.41	39.66	38.69	17.16	59.50	3.46	18.95	42.00	40.92
54 – 55	16.50	57.66	3.49	18.36	41.33	40.30	18.16	62.83	3.45	20.01	43.83	42.67
56 – 57	17.16	60.00	3.49	19.11	43.00	41.93	18.83	65.83	3.49	20.96	45.66	44.44



Figs 1–10. **1.** Presented clinical case with fractured limb; **2.** Measurement of height of the animal; **3.** Measurement of length of humerus; **4.** Measurement of length of femur; **5.** Measurement of circumference around axilla **6.** Measurement of circumference around groin; **7.** Comparision of lengths on a standard measuring tape; **8.** Mesurement of Parameters against a standard frame; **9.** Land marks showing bone length, height of the animal circumference of the ring; **10.** Clinical patient with modified Thomas splint.

= 3.23 + (0.71±0.01)×height of the animal in inches.

Similarly a relationship was established between the height of the animal and radius of the ring using regression analysis which was worked out as follows:

Radius of the fore limb Thomas splint ring in inches

= –1.41 + (0.34±0.01)×height of the animal in inches

Radius of the hind limb Thomas splint ring in inches

= –1.33 + (0.37±0.01)×height of the animal in inches

It was observed that the circumference of the ring around the axilla and groin was almost 3.5 times of the length of the humerus and femur bone, respectively, in all the animals, irrespective of their body confirmation and breed. In the preparation of the modified Thomas splint, attempt was made to provide desired traction on the bone (Nandi *et al.* 2009) as well as make the animal feel comfortable with this device. The ring was made from thin iron rod folded 2 to 4 times to bring in proper strength which helped to make the equipment light. The ring was sufficiently padded to prevent frictional skin abrasions at the point of contact during movement of the patient (Lundvall 1963, Walker 1970, Singh *et al.* 2002, Nandi *et.al.* 2009). Light weight bamboo rods have been used as extension arms as these are strong enough to support the weight of the animal and light enough to permit ease of movement (Walker 1970) and also reduce the weight of the splint. The weight of the ring varied from 34 to 945 g. The Thomas splint was applied for a minimum of 4 weeks. It has now become possible to calculate the length of the Thomas splint as well as diameter of the ring from the height of the animal through regression analysis. The Thomas splint combined with the cast served as the best device for successful fracture fixation without diminishing the normal function of the body (Adams and Fessler 1983) and failed rarely in properly applied cases (Singh *et.al.* 2002 and Nandi *et al.* 2009).

SUMMARY

For the fabrication of large animal Thomas splint an accurate size iron ring was prepared separately. The diameter of ring was correlated with the length of humerus for forelimb and with the length of femur for hind limb. In the second step, extension arms of the splint was prepared with strong bamboo pieces. The splint length and diameter of both the

legs were compared. At last a conclusion was drawn on standardization of measurements of Thomas splint which can be used to prepare Thomas splints on commercial basis.

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