CLINICAL COMPARATIVE EVALUATION OF THE V-CUT PELVIC OSTECTOMY IN THE MANAGEMENT OF CANINE HIP DYSPLASIA

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Abstract

The operational method (V-cut pelvic ostectomy) was applied on seven dogs. Pubic symphysis was cut in an inverted “V” fashion and a bone gap occurred between pelvic halves. The gap was reduced by contracting both sides of the pelvis. A new pubic symphysis developed. Results were evaluated with radiographs and different clinical and orthopedic tests. Radiographic measures between mutual parts of pelvic bone showed a marked increase in Norberg angles and diminishing in Bardens, Barlow, and Ortolani orthopedic tests after operations. Principal conclusion: V-cut pelvic ostectomy was found to be a successful operation technique in treatment of canine hip dysplasia.

Key words: dogs, canine hip dysplasia, ostectomy, juvenile pubic symphysiodesis.

Canine hip dysplasia (CHD) is one of the inherited diseases in dogs causing skeletal abnormality and joint incompatibility in hips. The disease is primarily defined as hip laxity in pathological aspect (16). The disease is progressive and leads to subluxation, damaged cartilaginous *labrum* in *dorsal acetabulum* rim (DAR), and osteoarthritis (OA) onwards (11). This degenerative joint disease (DJD) can be diagnosed by clinical, orthopaedic, and radiographical examinations (1, 7). Norberg angle is used to determine the radiographic joint laxity. Piermattei *et al.* (16) reported that the normal Norberg angles for Labrador Retrievers, Rottweilers, Golden Retrievers and German Shepherds were 99.9°, 101.9°, 92.6°, and 100.3°, respectively. Dueland *et al.* (7) found that juvenile pelvic symphysiodesis (JPS) dogs operated at earlier age appeared to have no progression in radiographic DJD according to their classification. The Orthopedic Foundation for Animals (OFA) classified the hips as excellent, good, and fair with borderline, mild, moderate, and severe for dysplasia on radiography (8). In addition, the Federation Cynologique Internationale (FCI) evaluated the disease as no sign, near normal type, mild, moderate, and severe hip dysplasia (21). Some tests such as Ortolani for hip subluxation, Bardens for hip translation, and Barlow for hip reduction signs are

also well recognised in diagnosis of CHD (2, 5, 9, 22). Conservative and surgical methods are used for treatment of CHD (4, 9). Surgical techniques offer various kinds of solutions for the treatment. General surgical practices are changing from juvenile pubic symphysiodesis (jps), femoral neck lengthening (FNL), toggle pinning (TogP), sacrotuberous ligament transposition, triple pelvic osteotomy (TPO), dorsal acetabular rim arthroplasty (DARthroplasty), pectineal myectomy (pectinectomy), femoral head neck osteotomy (FHO), neurectomy to total hip replacement (THR) according to the age of patients and status of disease (16). The remodelling techniques changing the pelvic bone structure are more effective than the others (16). Regaining the decreased function of the uneven joint is the aim of these surgical methods (12). Although these techniques are crucial and beneficial for the treatment some detrimental complications may occur after operation (6, 10). Different researchers (17, 19) reported that these operations resulted in intensive pain and restriction of activity up to 3 months. A new V - cut pelvic ostectomy (VPO) technique for the treatment of hip dysplasia was developed in the study. One kind of JPS and TPO combination was applied on the pelvis of dogs. The study aimed to present the changes in preoperative and postoperative periods with the means of clinical, orthopaedic, and radiological methods.

Material and Methods

The dogs (five females and two males) were selected from animals older than 4 months of age from large breeds. The mean body weight of the dogs was 28.8 kg, and the mean age was 7 months. The group consisted of Labrador Retrievers (3), German Shepherds (2), American Staffordshire terrier (1), and New Foundland dog (1).

Clinical, orthopaedic, and radiographic examinations results were recorded for each case pre- and postoperatively. Patients' weight, gait quality, body conformation, concomitant diseases, hip dysplasia signs and their incidence were reported with clinical assessments. Hip laxity amount (Bardens test), hip reduction angles (Ortolani test), hip subluxation angles (Barlow test) were evaluated in orthopaedic examinations (3, 20).

Pre- and postoperative radiological inspections in every case were carried out on pelvic bones. Pelvic area was also segmented in radiographical images and every segment was marked with a letter representing the distances between anatomical landmarks in pelvis symmetrically. Radiological results were evaluated and classified according to DJD, OFA, FCI (8), and the Norberg's angle scales.

During the study X-ray examinations were performed for 6 weeks in all cases and 6 months in first two cases throughout the study. Diametric pelvic measurements used in this study were described by Yaprakçı (23). Because of limited economic conditions of dog owners, tomographical methods could not be adopted into the study. Instead only radiographical methods were applied.

Dogs were anaesthetised according to total intravenous anaesthesia (TIVA) protocols with 6.6 mg/kg of 1% propofol (Fresenius Kabi), in constant rate infusion (2.20 mg/kg/h). A standard approach to the pubic symphysis was performed (15). Osteotomies were done by saving the underlying soft tissues. Cerclage wire was chosen as stabilisation type for the first two cases. Because of insufficient strength, a breakage occurred in the wire (1.00 mm thick) after a number of trials in the second case. It was replaced by another type of thicker material (1.40 mm). Monofilament non-absorbable suture material (Monofilament Nylon or Hard Nylon Leader, Mason Tackle Co., Otisville) was chosen for fracture stabilisation due to material's higher strength in repetitive trials. The same bone stabilisation was applied in all of other cases.

Clindamycin hydrochloride (Klimicin, Lek, 20 mg/kg) was used for 5 d postoperatively for all cases. Patients did not show any pain or related clinical signs during recovery. Therefore, pain treatment was found unnecessary according to owner's debriefing.

Legs were hobbled together to restrict the hind legs from excess abduction until healing approved and power of adduction recovered (16). Owners were warned to avoid unrestrained activity for 10 d. Skin

sutures were removed 10 d after surgery. Rehabilitation was found unnecessary in recovery period.

Results

Operational procedure. In surgical procedure, none of the cases were exposed to any complications such as massive bleeding, nerve damage, puncturing of the colon, urethra or underlying soft tissues. An intraoperative implant failure occurred due to weakness of the material used in osteosynthesis in case 1. A thicker wire was then used instead. In other cases (n=6), implant types were selected as nylon leader material. None of implant failures occurred afterwards. Long term radiographies verified healthy recovery in all cases. Case 7 developed skin wound complication due to owner's insufficient care. It was treated with antibiotic in recovery phase.

Radiologic inspections. Pelvic area was segmented with letters and represented in radiologic images (Figs 1, 2). Every letter in Figs 1 and 2 represents the distances between the landmarks of each symmetrical part in pelvis bones. The intervals among the symmetrical parts of pelvis were shown in Table 2. Percentage ratios of postoperative to preoperative measurements and postoperative segmental changes for 6 weeks in seven cases and 6 months in two cases were illustrated in Fig. 3. The highest reduction was observed in segment H at postoperative period. Segments D, E, F, G, and H in all cases were found to be underdeveloped. Similarly E, F, G, H, and J segment's development was also inhibited in two cases observed up to 6 months after operation.

Diametric results of radiographies of clinical cases are presented in Fig. 3.

Comparative radiographic classification results of clinical cases. Results of preoperative and postoperative radiographic and orthopaedic examinations (Ortolani, Bardens, and Barlow tests) are presented in Tables 1 and 2. The classification results of the cases in preoperative and postoperative period at 6 weeks were indicated in Table 1.

Five out of fourteen hip joint of seven cases converted to Ortolani negative by the week 6. Case 4 had symmetrical change for both sides. The condition in case 1 was unchanged postoperatively. The indicator of joint laxity decreased or turned into negative in all cases with regards to Bardens test in postoperative period.

The hip reduction angles turned into negative at least unilaterally and mostly bilaterally in terms of Barlow test. Case 3 was seen to have unilateral increase in right side Barlow test angle. Overall Barlow test improvement was 50%.

Figs 1, 2. Segmentation of pelvis in preoperative (left) and postoperative (right) phases

Fig. 3. Pelvic diameters of clinical cases (cm)

Table 1
Comparative radiographic examination results of clinical cases

		Case 1		Case 2		Case 3		Case 4		Case 5		Case 6		Case 7	
		R	L	R	L	R	L	R	L	R	L	R	L	R	L
DJD status	preoperative	3	3	2	2	3	4	3	3	2	2	4	3	1	2
	postoperative 6 weeks	4	3	1	4	3	4	3	3	2	2	4	3	1	2
OFA classification	preoperative	Sev	Sev	Mil	Sev	Mod	Mod	Sev	Mod	Mod	Mil	Mil	Mil	Fai	Sev
	postoperative 6 weeks	Sev	Sev	Mil	Sev	Mod	Mod	Sev	Mod	Mil	Mil	Bor	Bor	Go	Sev
FCI classification	preoperative	E	E	C	E	D	D	E	C	D	B	D	D	B	E
	postoperative 6 weeks	E	E	C	C	D	D	E	C	B	B	C	C	B	E
Norberg angle	preoperative	65	63	91	80	81	94	82	92	99	92	90	83	103	74
	postoperative 6 weeks	75	80	115	95	80	98	82	92	109	98	93	95	103	76

R - right, L - left, exe - excellent, go - good, fai - fair, bor - borderline, mil - mild, mod - moderate, sev - severe

Table 2
Comparative orthopaedic examination results of clinical cases

	Case 1		Case 2		Case 3		Case 4		Case 5		Case 6		Case 7	
	R	L	R	L	R	L	R	L	R	L	R	L	R	L
Ortolani test preoperative	(-)	(-)	+	+	+	+	+	+	+	+	+	+	(-)	+
postoperative 6 weeks	(-)	(-)	+	(-)	+	(-)	+	+	(-)	+	+	(-)	(-)	(-)
Bardens test preoperative	(-)	(-)	1.5	1.5	1	0.5	0.5	1	1	0.5	1	1	(-)	1
postoperative 6 weeks	(-)	(-)	0.5	0.5	0.8	(-)	0.5	0.5	0.5	1	0.5	0.5	(-)	0.5
Barlow test preoperative	(-)	(-)	5	10	(-)	(-)	50	45	20	30	(-)	(-)	(-)	40
postoperative 6 weeks	(-)	(-)	(-)	(-)	25	(-)	40	30	(-)	5	(-)	(-)	(-)	(-)

Discussion

The operation site has poor vascularity and neural network, and is suitable for easy surgical approach. Similar results were reported by Swainson *et al.* (18). In the study hip joint was turned into ventral direction during and after operation. This result is consonant with the finding of Dueland *et al.* (7). Hip joints were also turned in caudal direction distinctively. The mean DAR values in hip joints at 6th week and 12th month were found 7.4° for all cases and 9.5° for only first two cases, respectively. These values were lower than those of different researchers (7, 13) using JPS methods in juvenile dogs. These results suggested that the success rate of operation would decrease with the aging of patients. Similar results were reported by Dueland *et al.* (7) and Patricelli *et al.* (13). DAR values obtained in this study showed that the VPO technique assured relative success. According to some authors, JPS technique is less detrimental than others (7, 13, 14). Likewise, only one case out of seven dogs developed postoperative wound complication in the study. Radiographic results suggested that there were no significant differences between preoperative and postoperative stages in 6 week data according to classification of DJD, OFA, and FCI. Similar results were reported by Dueland *et al.* (7), who used JPS method in dogs younger than 24 weeks of age. Mean Norberg angles in left and right hip raised to 93.9° and 90.6° postoperatively from 87.2° and 82.6° in preoperative phase. DJD degrees of hip joints were seen unchanged in 6th week after operation. This finding was consonant with the reports of Dueland *et al.* (7).

A total of 11 positive Ortolani test findings were detected. Six (54%) of them turned into negative until 6 weeks postoperatively. On the contrary, Dueland *et al.* (7) reported that seven (70%) out of ten hip joints turned into negative in a 44 weeks period. This suggests that the effect of VPO occurs in a shorter time than JPS according to test results of Ortolani. Barlow tests also gave similar results except for only one case. This is consistent with the result of Dueland *et al.* (7).

As a result, three dimensional reconstructions can be obtained by VPO technique in dysplastic dogs. Differences between pre- and postoperative phases in

left and right hand sides of hips were significant in only left side ($P < 0.05$) suggesting that left hip joint was more affected by operation and showed quicker recovery than the right hip. VPO technique can be considered more effective than TPO and similar to JPS in the aspect of recovery period. VPO technique does not constitute an impediment for future operations in the same area. The technique is cheap and easy to implement. This is a successful method in the aspect of recovery period but further research with wider study groups would be useful for the improvement of the technique.

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