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TRAUMA AND GANGLIA OF THE SEMILUNAR CARTILAGES OF THE KNEE

By

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A large number of papers, particularly numerous during the thirties, have established the fact that ganglia of the semilunar cartilages of the knee are no rare occurrence, and that they present a uniform clinical picture. There is general agreement as regards treatment; the operative removal of the ganglion and the semilunar cartilage is recommended by the majority of authors to prevent recurrence. But opinions differ widely as regards aetiology and many theories have been put forward, though no irrefutable evidence has been presented in support of any of them. The part played by trauma is of particular interest for insurance purposes, and its significance has been viewed in greatly varying lights. Our main interest lies in elucidating the significance of severe, simple injuries.

There are several features in the clinical picture of ganglia of the semilunar cartilage which should be borne in mind in this connection. Thus, it would appear of some importance to be able to explain the fact, pointed out in all reports, that the ratio for the incidence of ganglia in the lateral and medial semilunar cartilages is about 5: 1, whereas clinically diagnosed ruptures are found more commonly in the medial cartilage. Regressive changes occur in roughly equal frequency in the two semilunar cartilages, so that no explanation can be found there. Opinions differ as to whether the medial or lateral cartilage is more exposed to simple injury. An explanation has then been sought in the nature of the injury to which the cartilage is subject. According to certain authors injury to the medial semilunar cartilage consists of a pull or stretch, leading to rupture; and in the lateral cartilage of a direct injury, often in the form of pressure. *Taylor*'s observation that ganglia in the lateral semilunar cartilage are localised exclusively to the central portion of the cartilage, the part subject

to direct injury, is of great interest in this connection. A result of this direct trauma has been thought to be crushing and colliquative necrosis of the cartilage, or haemorrhage with haematoma, leading to the formation of cysts in the affected areas. It is, however, only rarely that one finds microscopical signs of fresh or old haemorrhages in or around the ganglia, so that the haematoma theory appears to be unlikely.

Further, in view of the anatomy of the lateral semilunar cartilage, it has been considered that its weaker connection with the capsular ligament on the lateral side of the joint, and the resulting increase in mobility, together with the larger space in the joint, predisposes to the development of ganglia. The matter is, however, by no means satisfactorily clarified.

Ruptures in the semilunar cartilages were formerly regarded as being of traumatic origin in the majority of cases, and the presence of a rupture with a ganglion proceeding from the same semilunar cartilage should suggest a traumatic genesis. Cases of this type have long been regarded as rare. In recent years, however, *Borg* and *Albert & Keller* have pointed out that this combination is common; they have also shown that arthrograms in such cases disclose mainly horizontal ruptures of the semilunar cartilage. However, it is not possible either clinically or pathologico-anatomically to differentiate between a ganglion in a regressively changed, ruptured cartilage, and a rupture in a cartilage already affected with ganglion formation. *Albert & Keller* believe the ganglia to be the primary factor, and that in movement of the knee joint these displace the semilunar cartilage medially so that it is exposed to pressure between the condyles, resulting in ruptures.

Here we must bear in mind the almost physiological degeneration which usually occurs in both the semilunar cartilages as early as at the end of the forties, making the cartilage more susceptible to even quite slight injury. In 1948 *Lindblom* examined an unselected autopsy series of 200 knees, of all ages, with no trauma in their histories, and found ruptures in 68 of them. Regressive changes lead as a rule to the development of microscopical, cystic cavities in the cartilage tissue, by several authors termed intercartilaginous ganglia to differentiate them from the hypertrophic para-cartilaginous cysts which constitute the true semilunar cartilage ganglia. The incidence of the latter in Lindblom's series was 3 in 200; the figures were the same in Tobler's equally large series of autopsy cases. Many authors regard the microscopical cysts as an early stage in the development of true ganglia, and believe that injury affects their future course. *Borg* suggests that the mechanism functions as follows: the continuity of the semilunar cartilage is broken by a fissure or rupture, and subsequently the small

intercartilaginous cysts are pressed through the defect, forming a paracartilaginous ganglion.

The vascular changes often found in the outer portions of the semilunar cartilage have also been regarded as important to the development of the cystic changes, in that they impair the nutrition of the cartilage. Whether the changes, which usually consist of a marked thickening of all the layers of the vascular walls, are a primary degenerative phenomenon, or whether they should be regarded as sequelae to trauma, is still open to discussion.

A clinical fact which is hardly compatible with traumatic genesis is the absence of trauma in the histories of some half of the cases. Attention has been drawn to the frequent subclinical traumatisms to which the knee joints are subject in everyday life and which are not noticed or remembered by the patient. In *Sjövall*'s view the small degenerative cysts mentioned previously, regarded as the result of normal wear, are transformed into ganglia by repeated slight traumas. In support of this view he points out that the age charts for ganglia and medial ruptures, in his opinion undoubtedly of traumatic origin, correspond closely.

Static anomalies in the knee joints have been thought to lead to a greater measure of traumatism in the lateral semilunar cartilage, thereby playing a part in the manifestation of ganglia. An increase in valgus deformation would lead to greater loading by the pressure involved. If this were of any significance, however, women, having a greater degree of valgus deformation of the knee, would be more affected than men, whereas in fact the opposite is the case. A pathological varus deformation has been thought to produce an excessive lateral stretching of the ligament apparatus and a chronic suction effect on the semilunar cartilage, thus damaging the vessels and nerves in the area between the cartilage and the joint capsule and leading to degeneration and cyst formation. This theory was advanced in 1950 by *Bussebaum* when he reported on a series of 23 patients with club foot deformities and 4 with varus deformation resulting from fractures of the tibia, in all of whom a ganglion had developed in the lateral semilunar cartilage.

The view that an increased strain on the semilunar cartilage tissue leads to quicker and more marked degenerative changes is, however, not accepted by all authors. *Burman & Sutro* and others believe it to be degeneration purely due to age. *Chapchal* believes constitutional predisposition to be the most important factor as regards the development of regressive changes. In support of the theory of increased strain, however, we have the observations that ganglia are more common in

men, in persons engaged in hard physical labour, and the inhabitants of mountain regions. Very marked degenerative changes at an early age have been observed in Germany in labourers, house painters, bricklayers, and the like. In Eastern Germany this has been taken into consideration for insurance purposes, and chronic lesions in the semilunar cartilages have to be reported as an occupational disease.

However, the majority of authors criticise the view that trauma gives rise to ganglia. I would like to mention the following theories in which injury is not believed to be of any significance:

1. Ganglia are purely the product of degeneration. (*Payr, Burman* and *Sutro, Ghormley* and *Dockerty*, and others).

If this were so, the incidence of clinical symptoms of ganglia of the semilunar cartilages would rise successively up to the age of 50, when practically all semilunar cartilages show signs of degeneration. This is, however, not the case; ganglia of the semilunar cartilages are more common in younger people. (See *Sjövall* above).

2. Ganglia are the result of an active mucous secretion of certain mesenchymal cells (*King*).

3. Ganglia are true tumours, myxofibromas.

The German authors who uphold this theory (*Herzog, Wenig, Albert* and *Keller*) base their view on the concept that the cellular layer which lines the cystic cavities is of endothelial origin. *King*, and others, considers that she has, by means of silver staining, shown conclusively that it consists of flattened, specialised connective tissue cells, and that the German view is based on a misinterpretation of microscopical findings.

4. Ganglia are congenital formations which can develop from "embryonic remains" of arthrogenous tissue, which, for some reason, proliferates. (*Floderus, Ollerenshaw*).

5. Familiar factor. Some cases of ganglia of the semilunar cartilages have been described in siblings.

The insurance assessment of a case of ganglion of the semilunar cartilage is a difficult task in view of the uncertain genesis of the lesion. In medical insurance a ganglion of a semilunar cartilage was not formerly accepted as being the result of an accident, but in recent years this view has been modified to a certain extent. This is illustrated by the following 3 cases, two men, aged 21 and 36, and a 17 year old girl, (cases Nos. 1, 2 and 3). None of them had previously had any knee symptoms, but they received a direct trauma against the outer side of the knee in falls, hitting their knee against stone or an iron girder. After an interval of 2–6 months, during which period they all had pain at the point of injury, a ganglion was observed there, which in the female patient grew rapidly during the following months' observation.

The finding was verified in the two younger patients by operation. In the 21 year old man only that part of the cartilage which bounded the ganglion was removed, as the surgeon regarded the rest of it as healthy. Biopsy revealed a typical ganglion, necrosis and mucous degeneration in the excised part. The insurance company refused the compensation claims in all 3 cases "as it appears reasonable to assume that the manifestation of the disease was due to causes other than the accident". The Insurance Mediation Board nullified these decisions and made the following points in their argument:

a) the patients had previously had no knee trouble,
b) 2 of the patients were so young that degeneration appeared to be relatively unlikely,
c) the initial injury was severe,
d) the patients had never been free of symptoms since their accidents,
e) the ganglion developed at the place of injury,
f) the ganglion developed within a reasonable period of time from the date of the accident,
g) there were no signs of another knee joint disease.

During the past few years 3 similar cases of ganglion of a semilunar cartilage have been observed at the Orthopaedic Department of Karolinska Institutet. In these cases, too, there was direct trauma in the patients' histories, and operation revealed ruptures in the cartilage tissue in addition to the cyst. These patients had had no knee trouble before their accidents. In the case of a 27 year old man (case No. 4), a semilunar cartilage with a ganglion was removed two months after his accident. The ganglion had penetrated the fibrous capsule. Biopsy showed, in addition to a typical ganglion, a splintering of that part of the cartilage from which the ganglion proceeded, but no regressive changes. A 41 year old civil servant (case No. 5) had, 4 weeks after knocking his knee in connection with a flexion-abduction injury, a semilunar cartilage whose front portion was swollen, yellowish in colour, and loose in consistency. Macroscopically the observations resembled the start of a ganglion. Biopsy showed tissue with degenerative changes with small cystic formations and numerous fissures in the macroscopically changed area. In the third case (case No. 6) an operation 4 years after a severe pressure injury disclosed a ganglion the size of a white bean and a fissure in the degenerated cartilage tissue running towards the cyst. In biopsy the edges of the fissure showed fibrinoid necrosis, and the pathologist believed it to be an intravital formation, clearly of older standing.

It is clear that we are not yet in possession of any conclusively established and generally accepted concept of the aetiology of ganglia of the semilunar cartilages. It is possible that several different factors co-operate. The importance of simple trauma has been advocated by a number of authors, in Sweden by *Aleman & Friberg* and *Hinricksson* among others, but has been refused by the majority of authors and this has affected decisively the position taken up by the insurance companies. On the other hand, a rupture after even slight trauma has been readily accepted as the result of an accident. In view of observations made by authors such as *Lindblom,* who found ruptures in 68 of an autopsy series of 200 knees, selected without consideration for age, sex, or disease, when in the same series he found only 3 ganglia, this assessment appears to be inconsistent.

It is to be desired that the insurance assessment of these cases be more individual, taking into consideration the nature of the trauma, its localisation, and degree of severity, as well as the date af appearance of the symptoms in relation to the injury. In a case such as that described above, where a ganglion developed within a reasonable period after considerable trauma at the place of injury in a semilunar cartilage in which splintering but no regressive changes were present, it would seem desirable to take the accident factor into consideration.

Evaluation is made more difficult in the presence of marked degeneration in the cartilage. The advancing regressive changes do not, however, usually produce symptoms, and can be regarded as physiological. Thus, these patients too should be allowed compensation if their history and clinical picture suggest the trauma to have been of aetiological significance.

In no inconsiderable number of cases, on the other hand, the clinical picture and operational findings suggest that the ganglion was present before the injury, and that the injury only led to the revealing of the condition. In these cases it would appear justifiable to take the trauma into account as an aggravating factor.

CASE REPORTS

1. The Insurance Mediation Board's Case No. 6287/48. D. K. Female, 17 years. No previous knee trouble. Fell off her bicycle on 30th March, 1948, and hit the outer side of her left knee. There was immediate tenderness, swelling, and pain in the area. These symptoms never disappeared completely; they increased in severity after a few months. No locking. Consulted a physician on 1st July who palpated a ganglion of the semilunar cartilage the size of a bean against the lateral collateral ligament. Conservative treatment was tried at first, but without result.

During treatment it could be seen that the ganglion increased in size. Arthrogram negative on 11th October, 1948. Operation: Oct. 48: the lateral semilunar cartilage affected with ganglion formation was extirpated. At the attachment edge of the lateral cartilage immediately anterior to the collateral ligament a large, typical ganglion the size of a hazel nut was found. Otherwise the cartilage was normal. No biopsy made.

2. The Insurance Mediation Board's Case No. 3815/48. G. L. Male, 36 years. Lorry driver. No previous knee trouble. On 1st December, 1947, the patient jumped a little over 3 feet from a lorry, fell and hit the outer side of his left knee. The next day he had pain laterally across the knee which did not subside. He consulted a physician on 3rd January, 1948, who found tenderness and a diffuse swelling over the lateral joint space which did not, however, feel like a ganglion. Conservative treatment did not lead to freedom from symptoms. On 27th April a lateral ganglion was found to be present. The patient was admitted to hospital for operation but changed his mind at the last moment.

3. The Insurance Mediation Board's Case No. 1545/51. N. E. Å. Conscript, 21 years. While crawling on all fours on 29th June, 1948, he hit the outer side of his right knee. After this he had a swelling on the outer side of the knee, but otherwise no trouble. On 7th September he received an identical injury in the same place. That day the physician could find no ganglion at his examination. After the second trauma there was permanent pain laterally and stiffness in the joint. On 1st November the same year palpation disclosed a lateral ganglion the size of a hazel nut. An operation on 11th November revealed a typical ganglion in the semilunar cartilage; the ganglion together with the adjacent portion of the lateral cartilage was removed. The rest of the cartilage was left, as the surgeon believed it to be normal. Biopsy: a ganglion of the cartilage with regressive changes in the cartilage in the form of necrosis and mucous degeneration.

In 1951 the patient again consulted a doctor for knee trouble, and signs of chondromalacia patellae were found to be present.

4. N. B. I. (Orthopaedic Department of Karolinska Institutet) Case No. 7134/52. R. J. K. Male, 27 years. No previous knee trouble. On 11th November 1952 the patient hit the outer side of his right knee against the sharp edge of a machine. After this he experienced tenderness in the area. On 17th December his physician observed a lateral ganglion half the size of a plum. The operation took place on 22nd January, 1953: an incision was made over the resistance, showing it to be a ganglion which penetrated the fibrous capsule to the lateral semilunar cartilage, at which point the ganglion swelled to the size of half a plum. The lateral cartilage and ganglion were extirpated.

Biopsy: partially splintered semilunar cartilage from which a typical ganglion formation proceeded. No degenerative changes in the cartilage.

5. N. B. I. Case No. 7212/52. G. B. Male, 41 years. On a train journey the patient hit his knee against the steps to the upper bunk. The blow came medially and was combined with an abduction-flexion injury. There was immediate pain medially and swelling. On examination 4 weeks later there was medial pain over the joint space. Arthrogram: no changes in the medial cartilage. Operation 29th December, 1952: the anterior portion of the medial cartilage was swollen, yellowish in colour, and loose in consistency almost in the whole length of the incision; on the other hand there was no demonstrable rupture. Thus far the findings correspond with the arthrograms available. As far as one could see the posterior portion of the medial cartilage was intact. The cartilage was removed in the usual manner. In

view of the curious findings, which suggested the start of a ganglion, the cartilage was sent for biopsy. Quite severe chondromalacia was present in the upper part of the patella. Biopsy: macroscopical findings—parts of the cartilage tissue, some 2 cm. in length, were yellowish-white, partly fibrous, and dry. No rupture could be observed. Microscopical findings: in the incisions the cartilage tissue was seen to have numerous fissures and degenerative changes.

6. N. B. I. Case No. 7896/47. J. O. Male, 41 years. No previous knee trouble. In 1944 his knee was caught between two heavy iron girders; he received appreciable soft tissue injury but no skeletal damage. Subsequently he had permanent trouble in the form of dull aching and occasional discharges. He found it difficult to stand for any length of time. On one occasion his knee locked, and was released by manipulation. In 1947 a slightly tender resistance was found over the lateral joint space. Operation 4th March, 1948: the ganglion was about the size of a white bean. The cartilage was discoid in appearance and a 1 cm. long fissure ran from its inner edge in towards the ganglion. From the fissure opening one could introduce a small probe into a hole which ran towards the region of the ganglion. Biopsy: cartilage tissue with marked degenerative changes, and in one area numerous cavities of varying sizes. In one place a large fissure was observed running towards the strongly degenerated area. The edges of the fissure were in several places affected with fibrinoid necrosis. Judging from these findings, it was an intravital fissure.

SUMMARY

A short review is given of the various theories advanced on the aetiology of ganglia of the semilunar cartilages with particular regard to the part played by trauma. The author reports 6 cases in which he believes a direct injury to have been of significance. In three of these cases, which came before the Insurance Mediation Board, it was decided that an accident within the meaning of the insurance laws had occurred, and on this basis the author points out the importance of an individual insurance assessment of cases of this type.

RESUME

Examen sommaire des différentes théories avancées sur l'étiologie des ganglions des cartilages semi-lunaires, notamment par rapport au rôle joué par les traumas. L'auteur rapporte 6 cas dans lesquels il estime qu'une lésion directe a joué un rôle. Dans trois de ces cas soumis à la Commission d'Arbitrage de l'Assurance, il a été décidé qu'il y avait eu un accident dans le sens prévu par la loi sur l'assurance et, partant de cette base, l'auteur relève l'importance de la fixation d'une assurance individuelle dans les cas de ce genre.

ZUSAMMENFASSUNG

Eine kurze Übersicht der verschiedenen Theorien über die Ursache der Meniskuszysten, unter besonderer Beachtung der Rolle des Trau-

mas, wird gegeben. Der Verfasser berichtet 6 Fälle in denen nach seiner Meinung ein direkter Schaden von Bedeutung gewesen ist. In dreien der Fälle, die einem Versicherungsausschuss zur Begutachtung vorgelegt wurden, war die Entscheidung die, dass es sich um einen Unfall im Sinne des Gesetzes handle. Auf dieser Grundlage hebt der Verfasser die Wichtigkeit einer individuellen Versicherungsbegutachtung von Fällen dieser Art hervor.

LITTERATUR

1) *Albert, E. & Keller, G.:* Über Meniskusganglion. Zeitschrift für Ortophedie. 83: 228, 1953.
2) *Aleman, O. & Friberg, S.:* On injuries of the menisci of the knee-joint. Acta chir. scand. 74: 319, 1934.
3) *Baader, E. W.:* Sehnenscheidenentzündungen, Meniskus und Bandscheibenschäden als Berufskrankheiten. Neue Med. Welt. 1: 1297, 1950.
4) *Bennet, G. E. & Shaw, M. B.:* Cysts of the semilunar cartilages. Arch. Surg. 33: 92, 1936.
5) *Borg, T.:* Personal communication.
6) *Brav, E. A.:* Cysts of the semilunar cartilages of the knee-joint. The Mil. Surg. 105: 278, 1949.
7) *Burman, M. S. & Sutro, C. J.:* A study of the degenerative changes of the menisci of the knee-joint and the clinical significance thereof.
8) *Bussebaum, G.:* Beitrag zur Entstehung und Behandlung der Ganglien des fibularen Meniscus. Chirurg. 21: 337, 1950.
9) *Chapchal, G.:* Beitrag zur Frage der Meniscuscysten. Arch. f. ortoph. und Unfallchir. 42: 186, 1942.
10) *Colonna, P. C.:* Cysts of the internal semilunar cartilage. J. Bone and J. Surg. 15: 696, 1933.
11) *Dittrich, R. J.:* Concealed cysts of the lateral meniscus of the knee. J. Bone and J. Surg. 28: 646, 1946.
12) *Drehmann, F.:* Meniskganglion. Zentralbl. f. Chir. 75: 1477, 1950.
13) *Ghormley, R. K. & Dockerty, M. B.:* Cystic myxomatous tumors about the knee: Their relation to cysts of the menisci. J. Bone and J. Surg. 25: 306, 1943.
14) *Herzog, G.:* Über die Pathogenese der Meniskalen Ganglien. Virchow Arch. f. Path. Anat. 307: 27, 1940.
15) *Hinricksson, H.:* On ganglia of the menisci of the knee-joint. Acta Orthoped. Scand. 6: 156, 1935.
16) *King, E. S. J.:* Cystic development in the semilunar cartilage. Surg. Gyn. and Obstetr. 53: 606, 1931.
17) – The formation of ganglia and cysts of the menisci of the knee. Surg. Gyn. and Obstetr. 70: 150, 1940.
18) *Kleinberg, S.:* Cysts of the external semilunar cartilage with report of a case. J. Bone and J. Surg. 9: 323, 1927.
19) *Kulowski, J. H. & Richett, H. W.:* The relation of discoid meniscus to cyst-formation and joint mechanism. J. Bone and J. Surg. 29: 990, 1947.
20) *Lindblom, K.:* Arthrography of the knee. A Roentgenographie and Anatomical Study. Acta Radiologica. Suppl. 74, 1948.
21) *Malm, P.:* Om meniskganglion. Nord. Med. 1: 590, 1939.

22) *Norinder, E.:* Zur Kenntnis der Meniskusganglien im Kniegelenk. Acta Orthoped. Scand. 7: 362, 1936.
23) *Ollerenshaw, R. J.:* The development of cysts in connection with the semilunar cartilages. J. Bone and Joint. Surg. 16: 555, 1928–29.
24) *Ott, H. V.:* Meniskusganglien. Deutsch. Z.schr. f. Chir. 247: 560, 1936.
25) *Pisani, A.:* Pathognomonic sign for cysts of the knee cartilage. Arch. Surg. 54: 188, 1947.
26) *Silfverskiöld, W.:* Two cases of ganglion, originating from the internal meniscus of the knee. Acta Chir. Scand. 64: 549, 1929.
27) *Sjövall, H.:* Über Meniskusganglien. Acta Chir. Scand. 86: 561, 1942.
28) *Taylor, H.:* Cysts of the fibrocartilages of the knee-joint. J. Bone and Joint Surg. 17: 588, 1935.
29) *Tobler, N.:* Makroskopische und Histologische Befunde am Kniegelenksmeniskus im verschiedenen Lebensaltern. Schw. M. M. 10: 1359, 1929.
30) *Tryb, L. P.:* Meniscus und Trauma in der Rechtsprechung des Reichsversicherungsamtes. Monatsschr. Unfallh. 53: 161, 1950.
31) *Wallinheimo, L. V.:* Über die embryonale Entwicklung, Histologi und Degenerationserscheinungen der Menisken des Kniegelenkes. Acta Soc. Med. Fenn. Duodecim. Ser. B: 24, 1939.
32) *Wenig, K.:* Zur Geschwulstnatur der sogenannten Meniskusganglion. Frankfurter Z.schr. f. Path. 56: 23, 1941.
33) *Wijnbladh, Hj.:* Ganglion menisci migrans. Bruns Beitr. Chlin. Chir. 167: 177, 1937.
34) *Zadek & Jaffe:* Cysts of semilunar cartilages of the knee. Arch. Surg. 15: 677, 1927.