OBSERVATIONS ON KRUKENBERG TUMOUR OF OVARY

BY

SUDHIR BOSE, B.Sc., M.B., F.R.C.S., F.R.C.O.G.

Eden Hospital, Medical College, Calcutta.

Mason states that the occurence of Krukenberg tumour is not so rare as is usually supposed. Shaw showed an incidence of 1% in his series of cases. Dieckmann collected a total of 118 cases with Hundley's statistics. Vartan reported one case and collected about 150 cases from the literature. In many, the diagnosis is missed either due to the primary lesion in the gastro-intestinal canal being too small to be detected or to the "occupation bias", as Bland Sutton calls it, of the surgeon or gynecologist or to the exploration of abdomen after the disease has been far too advanced.

During the last 5 years 250 cases of ovarian tumours were treated at the Eden Hospital out of a total of 13,712 gynaecological admissions, i.e. an incidence of 1.09%. 203 i.e. 81.2% were cystic and 47 i.e. 18.8% were mainly solid in nature. The clinical and histological examinations suggested that 35 were malignant i.e. an incidence of 14%. Histological examination confirmed that 5 of these, i.e. 2% were Krukenberg tumours.

A short summary of these five cases is now presented in the accompanying table.

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The tumour is found in women — both young and old as first described by Krukenberg. The age in our patients varied from 20 to 40 years, with an average of 32 years. One has been reported in a girl of 15, by Krueger in a girl of 18 and by Vartan in a young woman of 20 years. The youngest of Krukenberg's series was aged 25 years. 80% of cases are said to occur before menopause. It is frequently met with in the child-bearing period of life. In our series all tumours were found in parous women — varying from first to seventh para — but it will be of interest to note that both cases were primiparae where the growth was supposed to be primary. Cases in unmarried women are rare; one has been cited by Jarcho.

Abdominal swelling was the general complaint. Pain was present in four of them and in one attention was first drawn to the swelling by the onset of pain. Vartan noted a 'blackout' or acute collapse in his patient. The case histories suggest that the tumour is not of slow growth as explained by Krukenberg. The longest duration was 10 months in Case I but only a month in Case 3. This is even shorter than the one cited by Jarcho which was of 6 weeks' duration.

Ascites was present in all except

TABLE I

Case Records of Krukenberg Tumour

Details of Patient	History	Clinical Examination	Laboratory Findings
1. 30 yrs. H. F. Para 7 Abdominal swelling for 10 months associated with scanty micturition and defaecation.	Periods regular. Last issue 4 yrs. back. Anorexia, nausea, discomfort and occasional diarrhoea for 2 months.	Weakness and debility. Free fluid in abdomen. Multiple hard nodular masses felt. Mobile.	Moderate degree of anaemia and leucocytosis.
2. 20 yrs. H. F. Para 1 Gradual swelling of abdomen — 7 months.	Last issue 4 yrs. back. Excessive bleeding during periods — 4 months. Loss of appetite and occasional pain in abdomen — 4 months.	General condition: good. Mass occupied Hypogastric region — hard, nodular and mobile. The swelling occupied more, the ant. fornix - uterus pushed back.	Anaemia slight. Ba-meal-no abnormality. Gastric analysis; normal acidity. Gastroscopic Exam: no abnormality. Ba-enema revealed nil abnormal.
3. 40 yrs. H. F. Para 1 Noticed a mobile swelling in abdomen —1 month.	Last child — 5 yrs. back. Periods regular before but admitted with history of amenorrhoea for 3 months. Pain in abdomen, with immobility of swelling — 7 days.	General condition: fair. Free fluid in abdomen. Hard irregular swelling in hypogastrium.	Moderately anaemic. Leucocytosis. Gastric analysis Hypochlorhydria. No blood. Occult blood-ve. Ba-meal filling defect at pyloric region.
4. 40 yrs. H. F. Para 6 Rapid swelling in abd.—6 months.	Last child — 7 yrs. back. Irregular periods —8 months. Acute pain in abdomen and vaginal bleeding — 1 month. Difficulty in breathing and dry irritating cough.	General condition: poor. Anaemia +1, Jaundice. Evidences of hydrothorax. Free fluid in abdomen. Cystic mass in hypogastrium, right lumbar and lower umbilical region.	Marked anaemia and leucocytosis E.S.R. 1st hr. 140 mm. 2nd hr. 160 mm. Ba-meal X-ray Stomach and duodenum normal. Hard fixed mass hypogastrium and rt. iliac region, adherent to small intestine and ileocaecal region. No sign of dilatation of proximal gut, but there was delay in emptying of terminal ileum. Bilirubin content 1% Icterus Index 8 Vandenberg—Direct immediate positive.
5. 30 yrs. H. F. Para 2 Rapid swelling in abdomen—4 months.	Last issue — 1 yr. 2 months back. Period regular, previously — lactational amenorrhoea. Pain in lower abdomen and back — 1 month.	General condition: fair. Irregular hard mass reaching upto umbilicus and occupying the hypogastric region. Free fluid in abdomen.	Anaemia — slight. Ba-meal showed no abnormality. Gastroscopy — congestion of mucous membrane only. Gastric analysis — NAD. X-ray of Lungs — NAD. Male toad test-ve.

Operation	Pathological Report	Microscopic Examination	Results of Operation & Remarks
Laparotomy:— Haemorrhagic fluid in peritoneal cavity. No adhesions. Multiple 'Sandeago' like nodules on peritoneum & omentum. Bilateral. Pylorus thickened and glands palpable. Panhysterectomy with bilateral ovariotomy performed.	Right:— Reniform in shape size 8″ x 7″ x 2″ Left:— Size 5″ x 4″ x 1½″ Hard mass with certain cystic areas, Surface glistening and lobulated.	Structure of krukenberg tumour in solid areas, cystic areas showed pseudomucinous change.	Patient developed sore-throat and difficulty in swallowing on 4th day after operation; otherwise uneventful post-operative period. She went home on 13th day signing D.O.R.B. She could not be traced after that.
The tumour arose from left ovary. The right ovary was slightly enlarged. No evidence of any other growth detected nor any enlarged glands. No free fluid-operation. Pan-hysterectomy with ovariotomy.	Left:— Size 4″ x 3″ x 1½″ Hard, irregular and glistening surface.	Typical krukenberg appearance. Rt. ovary revealed — Sclerocystic disease. No metastasis in tubes and uterus.	Patient discharged on 4th day but refused deep X-ray therapy — and is still living and healthy.
Laparotomy:— Pyloric thickening Stomach contracted Ascites fluid. Bilateral solid ovarian tumour. Total hysterectomy with bilateral salpingectomy and ovariotomy performed.	Size:— Right 6″ x 4″ x 2½″. Left—5″ x 3″ x 1½″ Hard, irregular, nodular and kidney-shaped.	Cellular tissue stroma and 'signet-ring' cells.	Patient made a good recovery. Advised deep X-ray therapy but died after 6 months.
Laparotomy done. Gall bladder seemed to be the site of malignant growth. Adhesions with omentum present. Multiple nodules in the omentum. Free fluid in peritoneal cavity — blood stained. Sub-total hysterectomy with bilateral salpingectomy and ovariotomy could only be performed due to low condition during operation.	Unilaterial solid ovarian tumour right sided. Hard and lobulated cystic in portions. Size 8″ x 6″ x 2½″. Left ovary—ordinary size and shape.	Typical picture of krukenberg tumour.	Patient died 6 weeks after the operation.
Laparotomy:— Bilateral solid ovarian tumour. Ascites - serous fluid. Careful search revealed no evidence of malignancy in abdominal cavity. Total hysterectomy with bilateral salpingectomy and ovariotomy done.	Hard lobulated. Size:— Right 6¾″ x 4½″ x 3″. Left 5″ x 3½″ x 2½″. (Fig. 1)	Cellular stromas and 'signet-ring' cells. Figs. II and III.	Patient made an uneventful recovery and discharged on 14th day after operation. But was re-admitted 3 weeks later with mass in lower abdomen and pain. No free fluid present. Deep X-ray given, but the patient died 6 months after operation.

Addendum: During this period another typical case of Krukenberg tumour was seen in private. I was told that she was operated in Tata Memorial Hospital but died within a period of about 6 months.

Case 2 — blood-stained in two of them. Hydrothorax was associated in one. Novak and Gray noted free fluid only in 4 out of 21 cases. Vartan also thinks that ascites is not usually associated, though his case had both hydrothorax and peculiar neurological signs.

Menstrual abnormalities were present in 4 cases — menorrhagia and metrorrhagia in two, amenorrhoea of 3 months in one and lactational amenorrhoea in the last. Vartan recorded irregular periods and amenorrhoea just over 2 months in his case.

The tumour is generally bilateral as reported by Krukenberg. Major quotes the percentage figure as 90. Both Bell and Vartan observe that it is not always bilateral like most metastatic growths of the ovary. Cases 2 and 4 of our series illustrate unilateral involvement.

The macroscopical appearance showed in all cases uniform enlargement of the ovaries and preservation of the ovarian shape (Fig. 1). The

Fig. 1
Macroscopical Appearance.

cut surface showed in most cases a general solid appearance with cystic degeneration, while areas of gelatinous appearance were common. They were enclosed in a smooth and firm capsule and none showed any surface growth even though peritoneal carcinomatosis was noted in two of them. Adhesions were generally absent but were found only with the omentum in Case 4.

The nature of the cells of a Krukenberg tumour has also given rise to much discussion. Very little can be added to what is already known regarding the pathology of these tumours. Krukenberg, in 1896, considered it essentially a sarcoma, finding the marked stromal reaction, but noting the presence of groups of large swollen cells with mucoid protoplasm resembling carcinoma cells he called the tumour a "Sarcoma Ovarii Muco-cellulare Carcinomatodes". Subsequent investigators (Schlagenhaufer in 1902, Amann, Cohn, Ewing, Bland Sutton, Major etc.) have definitely demonstrated that the growth is of epithelial origin and is often secondary to carcinoma elsewhere, especially in the gastro-intestinal canal. Certain observers have also diagnosed the condition as 'Endothelioma of the ovary' (Bode, Fleischmann, Palano etc.). Krukenberg himself also recognised its resemblance to an 'Endothelioma'. There is no case in our series where we suspected the sarcoma-like nature of the growth. The epithelial elements may be found in groups of well-demarcated acini or they may be completely or partially broken down but they invariably show the different degrees or stages of mucoid epithelial change. The accumu-

lated mucoid secretion flattens out the nucleus and pushes it against the cell wall. This explains the large number of 'Signet cells' in the tumour (Figs. 2 and 3).

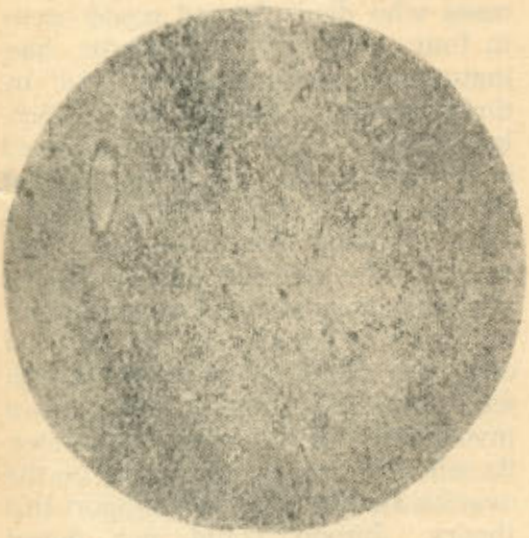

Fig. 2
Microscopical appearance—Lower power.

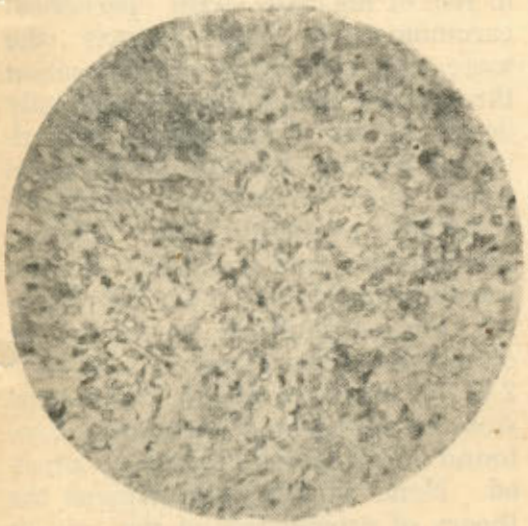

Fig. 3
Microscopical Appearance—High Power (Note the 'Signet-Cells' in the tumour).

The bone of contention in the genesis of the Krukenberg tumour lies in whether the growth is primary in the ovary or secondary to carcinoma of other abdominal organs. Krukenberg regarded the ovarian tumour as primary growth. But later it has been definitely proved (Kraus, Wagner, Schlagenhaufer, Stander, Glockner, Bland Sutton, Jarcho etc.) that it is in the vast majority of cases secondary to carcinoma of the stomach, intestinal tract, bile ducts or breast. This last upsets the suggestion that the primary is always a mucous-secreting carcinoma. This is also noted in some of our cases where the primary growth was of the type of scirrhous carcinoma or of linitis plastics. Of the 5 cases originally described by Krukenberg one complained of "stomach trouble" and another showed carcinoma of stomach accompanying the ovarian tumour. Ewing thinks that real Krukenberg tumours are always secondary. Bell classifies it under ovarian neoplasms — metastases secondary to gastro-intestinal carcinoma. Graves called them 'Alien Tumours' — metastatic from intestinal tract.

But there are a few cases on record where all the investigations failed to show any carcinomatous change in the gastro-intestinal tract. During operation no growth was detected anywhere else. The later follow-up also failed to reveal any sign or symptom of a growth in any portion of the gastro-intestinal tract. These are the cases recorded by Krukenberg, Sternberg, Schenk, Glockner, Frankl, Neuman and Andrews. In 1918 Major, on reviewing the literature, collected 55 undoubted cases of Krukenberg tumour plus 8 probable cases, and of these 63,

sixteen were probably primary in the ovary. Only after a very thorough and careful autopsy one should call a tumour primary in the ovary provided it presents all the macro- and microscopical characteristics. But Novak and Gray state, citing the cases of Andrews, Frankl and Neuman, that tumours should also be considered primary in the ovary if the clinical tests either during operation or later be negative and if the person lives free from symptoms of a gastro-intestinal cancer for a sufficient number of years after the removal of the ovarian growth. Case 2 in our series seems to belong to the group where the patient is living, quite healthy and free from any symptoms, more than two years after the operation. A similar case was reported from Eden Hospital in 1945 (Bose). But Case 5, like that recorded by Vartan, died 6 months after operation though none of the investigations carried out before, during and after laparotomy revealed any primary site of growth in the gastro-intestinal tract. Unfortunately no autopsy was allowed in this case. Novak, Dockerty and others explain that the primary growth in the ovary as described by Krukenberg may be of a teratomatous nature, where the mucoid entodermic epithelium may be the starting point of the malignant tumour of a muco-cellulare type. It will be of interest to note that in Case I the same growth in different areas showed both the characters of typical Krukenberg tumour and also that of pseudo-mucinous cystadenoma.

Even with all the investigations carried out it is not possible with the cases in our series to elucidate the method of propagation of this tumour. It was unfortunate that no autopsy was allowed in any of the cases who died. Spread could occur in four ways viz. lymphatic, haematogenous, sedimentation and by direct contact. Bucher, Kraus, Schlagenhaufer and Major explained such involvement by assuming that the cancer cells of the original growth after invading the serosa were conveyed to the ovarian surface by the peritoneal current and were implanted there, especially at the site of ovulation. None of our cases, though well advanced, showed any surface involvement of the ovary. Moreover, its selective implantation only on the ovarian surface does not support this theory. Jarcho could not detect any surface involvement of the ovary in two of his cases with 'peritoneal carcinomatosis' and supports the more accepted theory of propagation through the lymphatics, as originally described by Krukenberg. According to Kehrer, Amann and Jarcho there is an extensive retrograde lymphatic communication between the stomach and the ovary via the retroperitoneal and then the adjoining lumbar glands as proved by the dissection of the glands. In at least 2 of our cases the glands behind the stomach and around the pylorus were found enlarged and apparently affected. None of the cases support the theory of propagation of the cancer cells via the blood stream as advanced by Ribbert and Kauffman as no other organ apart from the ovaries was affected.

It is of practical importance with

regard to treatment to find out first whether Krukenberg tumour is primary or secondary. During operation on ovarian cancers other abdominal organs should be carefully examined and while operating for malignancy of the gastro-intestinal tract ovary should be thoroughly investigated. Secondly, one should also find out in such a case the extent of the involvement of the uterus, tubes and other pelvic organs. Frankl, in ovarian carcinoma accompanying primary growth in the gastro-intestinal tract, and Jarcho, in his 7 cases, found microscopic metastases in the uterus, tubes and vagina. Where the uterus was affected bladder was also found involved. On the other hand, the same observers found the uterus and tubes free from any metastases in 36 cases of primary ovarian carcinoma. It is agreed that the greatest growth occurs in the ovary accompanying carcinoma of gastro-intestinal tract. This is explained by some as due to the rich blood or lymph supply or to some hormonal influence. Major found enlargement, increased weight and hyperactivity of the pituitary gland in his case.

The treatment depends on whether along with the growth in the ovary the uterus and its appendages are affected or not, and also, how far the metastases have advanced in the abdominal organs and in the pelvis. Jarcho says that it is hardly justifiable to remove carcinomatous organs and leave others which are also affected. The treatment in general (Schauta, Neuman, Frankenthal, Schlagenhaufer, Frankl) is the complete removal of the uterus and adnexa along with the tumour. Modified Brunschwig's operation may be considered if bladder or rectum be involved. Some also recommend to perform gastrectomy in early cases of involvement of the stomach.

It has also been noted by all observers that no case of Krukenberg tumour of secondary type is cured by operation. They die soon after the operation. Our records also support the view. None of our cases of this type lived more than 6 months and deep X-rays following operation seemed to worsen the condition. Thirteen patients, out of twenty-one recorded by Novak, died within 6 weeks to 14 months after laparotomy, and in three others death was obviously imminent. Vartan's case lived only for $3\frac{1}{2}$ months. Both Shaw and Jarcho aptly remarked that there has been failure of both surgery and X-rays in the treatment of Krukenberg tumour and time has yet to show the ideal approach. But we have noted that the symptoms of pain, restlessness and general weakness are all relieved after laparotomy. On the contrary, the result of operation in a Krukenberg tumour of the primary type as noted in Case 2 of our present series, and also in one cited in 1945, seems to be favourable. So was also the experience of Andrews, Frankl and Neuman.

Summary

a) Krukenberg wrote about this tumour as late as 1896. The pathology is even now enveloped in various doubts in inferences. In general this is secondary and the primary may not be a mucous-secreting carcinoma.

b) The growth is comparatively rapid and occurs in parous women, young or old.

c) The tumour should not be called primary unless a careful autopsy is performed, when a patient dies, even though during operation, clinical or laboratory investigations revealed only the involvement of the ovary.

d) The prognosis may be favourable if the tumour is really primary in a rare case but operation is simply a palliative measure in general.

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