Significance of Arcus Senilis Under Anesthesia

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Arcus senilis, or gerontoxon, is an opaque, white or grayish ring or part of a ring, situated just within the scleroconal junction and separated from the sclera by a thin clear zone. Arcus senilis is most often seen in persons middle-aged or older; however, the phenomenon is also seen in young persons and even in children, where it is called arcus juvenilis. In most cases the phenomenon is not observed by the patient, but there are occasions when some anxiety is felt and the oculist is consulted. In some instances arcus may be disfiguring, and in exceptional cases an eye disease may develop. Although arcus is usually an innocent phenomenon, there is some speculation about its relationship with other diseases.

The studies to be reported in this paper were undertaken to show the significance, if any, of the relationship of arcus and its effects upon patients under anesthesia. First, however, a background of arcus must be formulated to better understand its relationship with organic diseases.

HISTORY OF ARCUS SENILIS

The idea that arcus is a degenerative change has persisted for many years despite protestations to the contrary. It is generally found in texts under the heading of degeneration.

More than a century ago, pathologists associated arcus with diseases of the heart and vascular system, thus attaching considerable internal medical importance to the anomaly. Arcus was believed to indicate sclerosed arterial walls in younger persons and to present other signs of premature senility. Others found it to occur in middle-aged persons with perfectly good arteries and refuted the idea that arcus is an early sign of arteriosclerosis.

Rohrschneider (1958) found arcus senilis of value as a sign of hypercholesteremia in young subjects. It cannot be taken to indicate arteriosclerosis in old people, however, since both affections are symptoms of old age. There are many contradictory statements about the correlation between the arc and the level of cholesterol in the blood. There is no doubt that many people with familial xanthomatosis have not only xanthoma but also a high blood cholesterol content, myocardial ischemia, and the senile arc. Different opinions are noted also with regard to the relationship between arcus and diabetes mellitus, gall stones, and lipoid nephrosis. Diseases injurious to the cornea may give rise to premature development of arcus.

Some investigators were of the view that arcus is due to diet and way of life. The possibility that persons with
Arcus have vitamin deficiencies has been considered, especially the lack of Vitamins A and C. There has been mention of the disappearance of arcus with the amendment of health. Many of the persons with vitamin deficiencies involved in these studies also had arteriosclerosis. As mentioned previously, there is believed to be a relationship between arcus senilis and arteriosclerosis.

The arc may appear as a family trait without any other apparent defect or accompaniment. For example, cases were recorded of a family of four males over three generations, the ages being 60, 29, 1 1/2 years, and 5 months. Similar family histories have been recorded.

METHOD OF STUDY
This study was carried out at a general hospital operated by the city in conjunction with the University of Cincinnati. The patients were medically indigent, and, with the exception of certain study cases, came from the lower economic strata of society. Most of the anesthesia was done by student nurse anesthetists and most of the surgery was done by surgical residents.

The anesthetists were instructed to observe all patients for the presence of arcus senilis and mark it on the anesthetic record when found. Probably some cases were missed, but 105 cases of arcus senilis were found out of 2717 patients anesthetized during the six months included in the study. This gives an occurrence rate of just under 4%.

Of these 105 cases, 60% were male and 40% were female, even though our operative ratio is more than half female. As seen in Figure 1, the arc was found in all age groups; but the greatest number were middle-aged patients in their fifties and sixties.

AGE DISTRIBUTION OF PATIENTS STUDIED

![Figure 1](image-url)
The control group was chosen to match the arcus senilis group as closely as possible in age and sex. An effort was made also to match the two groups in type of surgery, but similar cases could not be found in the older age groups of seventy and up.

All types of surgery were included in these two groups. In the arcus senilis patients, 45% had major abdominal work, as compared to 27% in the control group. However, the control group had 14% more head and chest surgery. All types of anesthesia were employed. There is not much difference in the two groups. In the arcus senilis patients, 60% had general anesthesia, 35% had spinal or epidural, and 4% had local. In the control group, 55% had general, 38% had spinal or epidural, and 7% had local anesthesia.

FINDINGS

In comparing the charts for significant factors of how well the patients did under anesthesia, a record of vasopressors administered to the two groups was studied. Since prophylactic vasopressors are given almost routinely prior to administering spinal anesthesia, only patients who received general anesthesia were included in this comparison. Sixty-three per cent of the arcus senilis patients under general anesthesia required vasopressors as compared to forty per cent of the control group. The number of continuous pressor infusions required under anesthesia was essentially the same for both groups.

Another area that gives significant findings is a study of the deaths. Out of 105 arcus senilis patients, twelve deaths occurred. This is a death rate of 11.4% as compared to an overall death rate of 1.5%. The deaths in the arcus senilis group were compared to all other deaths of patients who received anesthesia during the same six months. Out of 2612 cases, 39 deaths occurred.

CAUSE OF DEATH

Figure 2

<table>
<thead>
<tr>
<th>Cause of Death</th>
<th>Arcus Senilis</th>
<th>Non Arcus Senilis</th>
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<tbody>
<tr>
<td>Infection</td>
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<td>Pulmonary embolus</td>
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<td>Hemorrhage</td>
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<td>Heart failure</td>
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<td>Carcinoma, Trauma, etc.</td>
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Figure 2 shows the principal causes of death of the two groups compared. It should be noted that 50% of the arcus senilis patients died of infection. Since a Shriners' Burns Institute is located in our hospital, we give anesthesia to large numbers of burn patients. Badly burned patients accounted for over 15% of our deaths in the non-arcus senilis group and most of these patients died of infection.

Figure 3 shows the time of death postoperatively. The time ranges from two deaths in the operating room at the time of surgery to several deaths three or four months after palliative surgery for carcinoma. The one point that shows up most clearly in this chart is that 60% of the arcus senilis patients died in the ten to fourteen-day period postoperatively.

The impression mentioned earlier in this paper that arcus senilis seems to be a sign of arteriosclerosis is strengthened by our findings. The pathological reports on 42% of the arcus senilis deaths mention severe arteriosclerosis as part of the diagnosis.

SIGNIFICANCE OF FINDINGS

The presence of arcus senilis in middle-aged or elderly patients is a sign of poor risk candidates for surgery. These patients seem to require more major radical surgery — such as abdominal perineal resection — but tolerate the anesthesia and surgery poorly. They require more vasoressors under anesthesia and must
be managed carefully. Their postoperative course is often stormy, and they seem to have less resistance to infection. Many succumb to their infection two weeks after surgery.

We have used a variety of both conduction and inhalation anesthesia on these patients. The majority experienced some degree of hypotension despite the type of anesthesia used. It is obvious that these patients are poor risk for anesthesia and need expert handling. The anesthetist should try to avoid hypoxia, hypovolemia, hypotension, and electrolyte imbalance. The appearance of arcus senilis should be a forewarning of danger to the anesthetist. Choice of premedication, anesthetic management, and skillful supervision of the emergence period are all critical areas of management with these patients. In addition to awareness of the condition and expert management of the anesthesia, nasal oxygen during recovery and vigorous pneumonia prophylaxis is essential.

From our findings in this study, we are not able to recommend any one agent or technique as superior to any other. Rather do we recommend a minimum of anesthesia and a maximum of vigilance to bring these patients through the surgical stress safely.

BIBLIOGRAPHY