SURGERY OF VITREORETINAL DISORDERS - PAST, PRESENT AND FUTURE

The time before Gonin: Retinal detachment has always presented for the patient a dramatic and terrifying experience, and for the surgeon a source of frustration for a long time. Practical knowledge in the 19th century was based on pathoanatomical observations, and therapy consisted of drainage and bed rest. Invention and introduction of ophthalmoscopy by Helmholtz in 1851, when the fundus could be observed in vivo for the first time, meant the decisive step in comprehending and therapy of retinal detachment. Nevertheless it took 70 years to totally comprehend the course and dynamics of the pathological process. The main components of this process - traction, fluid current in the eye as well as the hole in the retina were observed separately, but were not causally connected. The importance of particular components of the pathological process were either over- or underestimated, the therapy itself was the result of the surgeon’s hypothesis. Cutting of »vitreous strands« - Deutschmann, Graefe; intraocular injection of various substitutes with or without drainage of subretinal fluid; extensive diathermy - Lagrange; shortening of the bulbus - Mueller, combined with strict bed rest and positioning were some of many futile attempts whose rare positive results were at the most only temporary.

At the beginning of the 20th century, after long studies of pathological specimens, ophthalmoscopic observation of dynamics of pathological process and looking for holes in the retina, trying all the hitherto applied surgical methods in treatment of retinal detachment Jules Gonin, Lausanne, Switzerland, came to the epochal conclusion that a hole in the retina is the cause of detachment. Using Paquelin thermocauter to perforate the bulbus on the spot of defect and incarcerating its edges by withdrawal of the needle he achieved reattachment of the retina. Using this method he succeeded to reattach the retina in 40 – 50% of cases. After long years of disbelief and refusal he finally got recognition for his work at the international congress in Amsterdam in 1929. His enthusiastic followers were Arruga in Spain, Amsler in Switzerland and Wewé in the Netherlands. However, of in spite of the success rate of 40-50% in hitherto inoperable conditions a great number of cases could not be treated successfully. The reason was that the treatment did not comprise the other two components of the pathological process: vitreoretinal traction and fluid current in the eye. Shortening of the bulbus to reduce its volume as introduced by Lindner and later by Wewé, based on earlier attempts by Mueller, showed certain positive results.

Time after Gonin: Introduction of scleral indentation was a capital contribution in this surgery, as it simultaneously treated all three components of the pathological process: v.r. traction, fluid current as well as their consequence - retinal hole. The first attempt at indentation - »buckle« - was noted 1937, when Jess sutured
a gauze tampon under Tenon's capsule. Although basically logical, this attempt did not find followers. The father of «buckle» surgery was undoubtedly Ernst Custodis, Duesseldorf, Germany, who used a plastic egzoplant sutured on the sclera. This technique was soon accepted, and increased positive results in this surgery to 80%. However, frequent complications of the bulbus penetration due to hardness of the plastic material, combined with surface diathermy, inspired surgeons in many countries to look for other solutions. For detachments with multiple holes in the periphery Arruga introduced cerclage equatoriale – circumferential buckle – by suturing nylon thread through the sclera on the equator of the bulbus. The method appealed by its logic and simple use. Perhaps that is why perforation of the bulbus during surgery, and ischemia of the anterior segment postoperatively were rather frequent complications. The idea itself was perfected by Schepens, Boston, USA, who used softer material: silicone. An encircling band with or without a radial buckle, combined with diathermy, totally replaced Arruga’s cerclage. Complications with plastic material inspired Pofique and Spira Lyon, France to use biological material – human sclera. Lamellar scleral pocket – poche scléral – filled with pieces of the human sclera or sutured upon the sclera – poche apportée – filled with the same material were frequently used in the 60s. At the same time Kloeti, Zuerich, Switzerland, propagated use of the fascia lata as cerclage material. Naturally, biological material did not cause any complications, but the effect of indentation was shortlived and in some cases caused redetachment. Looking for new materials more or less ended when Linkoff, New York, USA introduced silastic sponge and replaced diathermy by cryocoagulation. In the early 70s this became the method of choice in treatment of detachment and has been sustained as such up to the present time. Recently hydrogel as the material for indentation has not brought much change.

Retinopexy and tamponade. I want to say a few words concerning two procedures important for v.r. surgery: retinopexy and tamponade. Purpose of retinopexy is creating chorioretinal scar and has no influence on v.r. traction. After use of the thermocauter at the Gonin time surgery moved on to nonperforative diathermy as introduced by Pischel. Diathermocoagulation, technically improved by Wewe was applied for many years. In the 70s Linkoff, following Bietti’s (Rome, Italy) experience, combined silastic buckle with cryocoagulation, which, properly used, did not damage the sclera. It should be mentioned that extensive use of diathermy but also of cryocoagulation, may have very serious consequences and provoke proliferative process in the eye. At the beginning of the 60s Meyer Schwickerath, Essen, Germany, introducing xenon photocoagulation opened a new chapter in retinopexy. Laser coagulation based on the same principle and introduced by Zweng and Little, USA, was much easier in technical use and completely replaced xenon photocoagulation. In this way the chapter of retinopexy has been completed.
Owing to Ohm's attempt in 1911 to treat retinal detachment by means of intravitreal air injection he could be regarded as the forerunner of tamponade. With much more understanding of the pathological process Rosengreen, Goeteborg, Sweden, uses the air as tamponade in 1938. In the beginning of the 70s Norton, Miami, USA, introduces SF6, and in the early 80s Linkoff brings in longlasting gases, which have the advantage of longlasting tamponade and disadvantage of expansion under low pressure.

Tamponade is fully effective only when combined with indentation. Without indentation, propagated as fast and cheap surgery, it only has a temporary effect because of persistence of V.R. traction. From the early 70s »buckle« surgery combined with cryocoagulation, drainage if necessary, with or without tamponade has become the method of choice in treatment of retinal detachment and it is successful in 90-95% detachments with the mobile retina. But it failed with detachments with multiple equatorial ruptures, with giant tears, with detachments caused by proliferative process.

Introduction of silicone oil. In the 70s Paul Cibis, Saint Louis, USA, introduces silicone oil in retinal detachment surgery. Under control of binocular opthalmoscope in reversed picture, using surface tension of sil. oil and expansion of the sil. bubble he tries to separate the detached retina from the changed vitreous and fibrotic membranes. At the same time he tries to attach the retina by evacuating intraocular fluid. At the successful result he leaves sil. oil in the eye as permanent tamponade. By this extremely difficult technique he achieves surprisingly good results with some hitherto inoperable cases. Probably owing to its difficult application this technique has few followers in USA (Okun Watzke) in the middle 60s there are published attempts at use of this technique in some European countries – Moreau in France, Dufour in Switzerland, Liesenhof, Lund in Germany. Cibis' early death as well as legal problems concerning use of sil. oil being an industrial product not registered at FDA brought about that this method was not more widely used. In Europe surgeons did not use binocular ophthalmoscope and were not very familiar with dynamics and consequences of pathological process in the eye, which brought bad results and unsuccessful end of use of sil. oil in Europe at the end of the 60s.

Optical microscopy. Now I would like to say a few words about development and use of ophthalmoscope. As it was said before, in 1850 Helmholtz introduced ophthalmoscope, which technically consisted of a strong source of light near the patient's head, a concave mirror with a hole in the middle through which the surgeon – by means of reflected light via convex lens – could see the lightened fundus. In the middle of the 20th c. that system developed into a sophisticated ophthalmoscope with light and a system of lenses, which was used as both direct and indirect ophthalmoscope. Development of visualization was of crucial importance for development of v.r. surgery and had a curious course. In the early 50s Schepens, Boston, USA, and then Fison in London, UK designed the binocular indirect ophthalmoscope, which in those years was
accepted and used in those countries. In Germany Zeiss ophthalmoscope for direct and indirect ophthalmoscopy had been in use from the earliest times. In the 60s it was replaced by the bonoscope, indirect monocular ophthalmoscope with extra strong light. In France indirect ophthalmoscopy was as good as unknown and the direct ophthalmoscope was used in surgery, which culminated in use of Goldman's 3-mirror glass under the microscope. Superiority of the binocular indirect ophthalmoscope with the possibility of indentation of the periphery was obvious, so that in the 80s it was eventually in general use. For diagnostic purposes, besides the ophthalmoscope, Goldman's glass as well as the panfundoscopy for its panoramic picture were used. In the 90s they were all replaced by 90D lens.

Modern times. In the early 70s John Scott, Cambridge, UK, impressed by Cibis' results with sil oil, went himself into treatment of complex cases, where conventional technique was unsuccessful. Trying to separate fibrotic membranes and the changed vitreous from the contracted retina by means of expansion of the sil.bubble, he also used intraocular instruments. He used the bent pick needle to lift membranes, the blunt flute needle for fluid evacuation, scissors. The surgery was performed under control of binocular ophthalmoscope in reversed picture. With positive outcome the central retina would be reattached and the fibrotic tissue and membranes would be pushed to the periphery. Sil oil would stay as permanent tamponade preventing renewed contraction of fibrotic tissue. By his skill, insight in the course of pathological process, as well as by his enormous persistence, John Scott achieved remarkable results. Owing to difficulty of the procedure itself and his good results, only a small number of surgeons could be compared to him, so that Cambridge was the place of reference for patients from all over the world. With this method John Scott has made a huge step in treatment of difficult cases, but even this method had its limitations. Giant tears with PVR, traumatic detachments with the incarcerated retina, diabetic tractional detachment and others could not be treated successfully in this way. Permanent tamponade with sil oil also caused complications in the long run.

At the end of the 60s David Kasner, Miami, USA tried a new treatment of prolaps of the vitreous at cataract surgery and trauma of the eye and called it open sky vitrectomy. Using cellulose sponges and scissors he removed the prolapsed vitreous. By successful surgery he proved that the vitreous was not of vital importance to the eye. In 1970 the new technique inspired Robert Machemer, Miami, USA, with technical assistance of J.M.Parel to design an instrument which enabled entering vitreous space through relatively small opening, and under the microscope to remove the blurred vitreous. Multifunctional instrument Vitreous Infusion Suction Cutter was a revolutionary step in history of v.r. surgery. Short time after that O'Malley introduced bimanual system with a separate source of light and standardized system of 20 gauge instruments. P.p vitrectomy
opened new possibilities in surgery of the vitreous, but it was not aimed at treatment of retinal detachment. What's more, fear of injuring the retina during surgery was great and comparable to fear of loss of the vitreous in earlier cataract surgery. In USA, standard procedure for treatment of the retinal detachment for more than 10 years was the silastic buckle with cryopexy and possible gas tamponade. Complex cases of detachment with proliferative process usually were not operated. The only kind of detachment in which vitrectomy was implemented, was detachment caused by a hole in the macula, which due to its location hitherto presented a problem. In the past indentation techniques were applied with modest success, such as the silver ring of Rosengreen, the silver plomb of Gloor, Zuerich, Switzerland, and others. For this kind of detachments, p.p. vitrectomy with removal of epiretinal membranes, gas tamponade and positioning was the method of choice then and now. In more recent time relocation of the macula as introduced by Machemer in the 90s is one more indication for implementation of vitrectomy.

P.p. vitrectomy has opened new possibilities for research of proliferative process, which now can also be followed in pathological specimens of tissue from the eye. In the late 70s Machemer described proliferative process in the eye on the basis of acquired specimens and clinical experience, and introduced the familiar name Proliferative Vitreo Retinopathy (PVR).

P.p. vitrectomy was rather hesitantly accepted in Europe by way of pioneers in particular countries: Kloeti in Switzerland, Laqua and Heimann in Germany, Leaver in UK. In the 70s Jean Haut, Paris, France, as the first combines vitrectomy with sil.oil.

The new concept. In the early 70s, exercising retinal surgery in Rotterdam, the Netherlands, I was unsatisfied with my results. Visiting other centres in Europe – Zuerich, Bonn, Paris – and comparing my work with that of the others I did not notice big difference in results. After several visits to John Scott I was convinced that his technique and approach were absolutely superior to anything I had seen before. In the late 80s I implemented his technique in surgery of a considerable number of patients and achieved results satisfying for that time. After a year, together with Diane Mertens, I abandoned binocular ophthalmoscopy and combined vitrectomy with sil.oil, using it only as temporary tamponade. As the admitted patients were more and more difficult, it was soon obvious that this technique also had its limitations. In complex cases, when due to proliferative process the retina was contracted, incarcerated or shortened, removal of all membranes and scar tissue was not sufficient to bring the wanted results. The only solution for these cases appeared to be surgical intervention – retinotomy, retinectomy. Treating in this manner in the beginning only the one-eyed patients in a desperate situation, in a short time I operated a considerable number of the most difficult, hitherto inoperable cases with positive results. So I established a new concept of treatment, which consisted of vitrectomy, meticulous removal of all epi- and subretinal membranes,
retinal surgery, laser coagulation and temporary tamponade with sil. oil. After the first publications and frequent presentations at meetings, the introduction of retinal surgery in the arsenal of surgical measures was soon accepted and adopted.

In the very beginning of the development of this demanding technique I was confronted by absence of adequate instruments for this new kind of surgery. Presence of Ger Vijfvinkel, the technician in our hospital, was crucial for development of new instruments. His frequent presence in the operating theatre and monitoring of surgery resulted in fast designing and construction of adequate instruments. Besides numerous small instruments we developed together the foot-driven silicone pump, the back-flush needle, 4-port system, 25-gauge vitrectom and instruments, replaced Ando's plastic tacks with steel ones for peroperative use, etc. Ger Vijfvinkel with his inventiveness contributed considerably to development of v.r. surgery.

This new, more aggressive concept of v.r. surgery had not many postoperative complications. After introduction of 6 o'clock iridectomy (Ando, Japan, 1986) the problem of pupillar block was solved. Other complications could be ascribed to inadequate performing of surgery or to continuation of proliferative process which had caused frequent reoperations. This proliferative process was also often provoked by careless surgery. It should be mentioned that the pathological basis of all complex cases was biological process and that surgical therapy is only adequate and indicated for the want of better and more suitable therapy.

In the last 20 years no radical changes in therapy have occurred. Introducing PFCL - heavy liquid Stanley Chang greatly simplified surgical process. Double filling silicone with PFCL as used by Peperkamp, Rotterdam, Netherlands, in prevention of inferior detachment gave positive results. Improved visualization of membranes by use of colours - tripan blue - as well as triamcinolone acetonide for better visualization of vitreous cortex have made surgical process easier and safer. Use of finer instruments, thinner vitrectoms as well as sutureless vitrectomy simplified the course of surgery. With all this technical progress, meticulous removal of complete proliferative tissue before retinal surgery and injection of sil. oil, is the absolute condition for success of the operation.

»Buckle« surgery with the binocular ophthalmoscope and its success of 90-95%, with the mobile retina and correctly performed is practically without complications. (Choroidal bleeding at drainage is the complication most frequently mentioned, which we practically brought to zero by using the blunt lacrimal probe for penetration of the choroid after incision of the sclera.) This conventional surgery is much cheaper than vitrectomy regarding both personnel and instruments. P.p. vitrectomy is in itself an invasive method with more possible complications such as endophthalmitis, cataract etc. However, nowadays there are few people ready to master indirect ophthalmoscopy and
I am afraid that in future conventional surgery will lose battle with 9D lens, wide angle microscope and vitrectomy.

After this long talk I would like to add a few comments. Following development of the surgery an old truth is repeated again: that every, even the most important step in development, does not exist by itself but builds on earlier achievements of its predecessors. Still, development of v.r.surgery was many times slowed down for seemingly ununderstandable reasons. For instance: it took long years before absolutely superior binocular ophthalmoscopy was generally accepted in Europe. Then: more than 10 years after the epochal invention of p.p.vitrectomy, complex pathology was not treated in USA, while at the same time such cases were successfully treated in Cambridge. How to explain it: complacency, vanity, conservatism, arrogance? Perhaps some of it all but the main reason was deficiency in flow of information. For a long time retinal surgeons were seen as curious people hobbyists, and isolated. Marked by bad results with both successful and unsuccessful operations. Prestigious bi-annual Gonin club meeting was for a long time almost the only place for exchange of ideas and experiences. The technique of presentation was weak and unconvincing. Mutual visits were not frequent and common, and learning and transfer of knowledge, were not formalized, at least not in Europe.

This situation dramatically changed in the early 80s. With introduction of new surgical methods, new technology and better results, interest in new surgery increases. At innumerable meetings new surgery is presented by new visual means: film, video, live surgery, in an attractive, instructive and impressive way. In the first years that development was limited to the developed countries, but now it covered most countries that could afford it. V.r. surgery is not restricted to a small number of places, the number of centres as well as the number of v.r. surgeons has multiplied.

However, this very optimistic and stimulative development is followed by another, much less positive. For long years existing management in health service with the purpose of cutting expenses introduced the system of general rationality and control. This system, which has saving of money and time as its main aim and is undoubtedly useful in many aspects, but, often neglects interests of the patient. In its aspiration to maximize results in the shortest possible time – calling the operation a product and the patient a client – this system is focused on routine surgery. The patient with complex pathology demanding long operations is not a welcome guest. Working in such circumstances, pressurized by hospital, an insurance company, a lawyer in front of the operating theatre, the surgeon is less and less stimulated to treat difficult cases with uncertain outcome and prospect of reoperations. Add to it lack of challenge and attractiveness of this surgery in the pioneer time and deficiency of material stimulation, then negative selection of difficult cases becomes understandable and more and more frequent. Besides the fact that not operating of such cases is an ethical offence, it also has other
far-reaching consequences. More and more frequent selectioning and excluding of these cases becomes settled practices. The decreased number of such operations whose pathology is restricted anyway, and its distribution on a great number of centres and surgeons, questions experience building of the surgeon as well as the quality of his work. In such situation transfer of experience in this atypical surgery to the younger ones also becomes questionable. Solution of this unfavourable situation, which gets worse continuously, is separation of difficult, complex cases, and concentration of their treatment in corresponding centres. There, experienced surgeons, working without pressure and limitations, would give such patients corresponding treatment. In the same places young surgeons would get the opportunity to achieve knowledge and experience.

Institutions in charge of health expenses, which underestimatingly watch the modest result of this demanding surgery, and which by their attitude do not stimulate its development, have to remember that the operated patient with the final visual result, light projection or hand movement demands much less money from society than a totally blind person.

Dear colleagues, working for 30 years in this field I was lucky to take part, passively and actively, in the most exciting segment of development of this surgery. I have written this paper mostly according to my memories. I may have forgotten a name, used a wrong detail or date and I apologize for it.

Thank you for your attention.