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Mandibular Fracture Complications in the material of the Maxillofacial Surgery Ward of the Radom Specialist Hospital in the years 2010 – 2020.

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SUMMARY: The study was retrospective. In 2010-2020, 1716 patients diagnosed with a jaw fracture were treated in the Maxillofacial Surgery Ward of the Radom Specialist Hospital. Data were obtained from routine medical records: medical history of the Ward and the Hospital Outpatient Clinic. Correct and complete data was collected in 611 disease histories. Among these patients were 541 men and 70 women. The follow-up period after fracture repair was up to 3 years. During this period, i.e. after 6 months to 3 years, 224 patients were examined.

The variables analyzed included demographic data, circumstances of the injury, location of the injury, accompanying injuries, concomitant diseases, postponement of treatment, treatment method, treatment time, early and late complications, and functional assessment of the masticatory state.

KEYWORDS: mandibular fracture, mandibular fracture complications, treatment of mandibular fracture complications

I. INTRODUCTION

A complication is a medical condition which is a consequence of another illness, surgery or improper treatment. In contrast to a medical error it is an unintended result of medical treatment and does not arise as a result of violation of the medical treatment principles. Doctors of all specialties can encounter complications in their everyday practice but, in particular, they are most frequent in the field of surgery.

The progress that took place in the maxillofacial surgery, the widespread of surgical treatment with the use of stable miniplate osteosynthesis, changed the treatment methods and problems related to the post-operative procedures. On the one hand, broadening of indications for surgery allows for more and more effective treatment, on the other, it may result in the occurrence of more and more complications. Improper treatment of mandibular fractures may result in durable morphological and functional consequences. They impair normal functions of the stomatognathic system as well as the whole body. Malocclusions which accompany mandibular fractures as well aspost-traumatic deformations can cause facial asymmetry and impair facial aesthetics which significantly translates into a psychosomatic disorder of the patient.

Mandibular fracture complications may appear at the moment of injury, during applied treatment or in a longer time. They can also result from the absence of treatment. They can be caused by both a physician and patient. Mandibular fracture complications include a number of symptoms, from minor ones with insignificant consequences like, for example, prolonged healing or temporary sensory disturbancesto more serious and long-lasting like malocclusions, facial asymmetry, neurosensory deficits resulting from nerve damage, difficulties in taking food, osteitis or non-specific pain, acoustic symptoms and abduction disorders. All these complications occurring immediately after the injury and those which despite applied treatment persist for a longer period of time, bring with them major negative consequences for the patient.

In the years 2000-2018, 1716 patients were hospitalized at the Maxillofacial Surgery Ward of the Radom Specialist Hospital due to mandibular fractures. The largest group of fractures were single fractures within the corpus of the mandible. Majority of hospitalized patients were men. The prevailing treatment technique was stableminiplate osteosynthesis. This method enables immovable fixation of fragments which accelerates the pace of bone healing and reduces the risk of post-operative complications. At the turn of the 20th and 21st century treatment methods evolved from conservative orthopaedic and surgical-orthopaedic methods to surgical methods only. Currently, the applicable standard of mandibular fracture management is stableminiplate osteosynthesis. Orthopaedic techniques of immobilization are used less and less frequently as basic treatment procedures and they have become supporting methods for surgical treatment.

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At the Maxillofacial Surgery Ward in Radom the patients with mandibular fractures are admitted on an outpatient basis or emergency basis. In cases of major displacement of mandibular fragments at the moment of admittance the patients are temporarily provided with wire ligatures or chin foundation. When the patient is qualified for orthopaedic treatment, intermaxillary immobilization in the form of standard cap splints tied to the teeth with wire ligatures and flexible intermaxillary fixation is applied under local anaesthesia during the first 24 hours after admission. In patients qualified for surgical-orthopaedic treatment immediate intermaxillary immobilization is sometimes postponed and carried out in the operating theatre following the osteosynthesis procedure. It is the anaesthesiologist who after necessary tests and consultations qualifies for surgery under general anaesthesia. Mandibular osteosynthesis is carried out under general anaesthesia in the operating theatre. In most cases the endotracheal tube is inserted through the nose. Intubation through the mouth is applied in the situation when it is not important for the intraoperative control of occlusion. Submental intubation is appliedin the situation of concomitantjaw, nasal bone and skull base fractures which are the reason for contraindicating intubation through the nose. Fractures in the submental segment is managed through the intraoral approach technique, most often with the use of two titanium miniplates, like in the case of the premolar segment fracture.

Fig 1 – Fracture management in the submental segment (intra-operative)

Mandibular angle fractures are managed with the use of a transcutaneous guide bar and trocar, also with the use of two titanium miniplates.

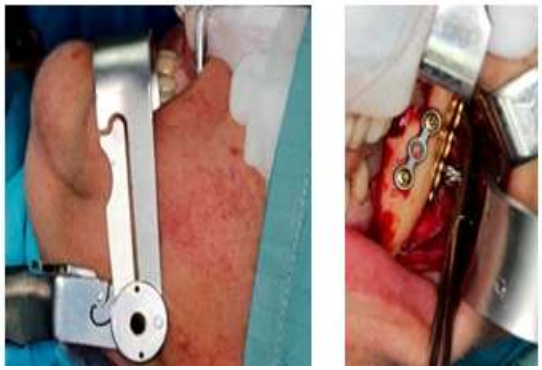

Fig 2 – The use of transbuccal guide bar for mandibular angle fracture management (A – extraoral picture, B – intra-oral picture)

Fractures of mandibular branches and condylar process as well as all other cases of fractures with major displacement of fragments, lack of support in the molar zone, undisplaced fractures, comminuted fractures or with a complicated inflammation are operated with the use of extraoral approach.

FIg 3 – Transsalivary approach at condylar fracture management (intra-operative)

A set of titanium miniplates, most often 2.0 mm with the use of grade 2 titanium is used for osteosynthesis, whereas reconstruction plates are used in cases connected with bone grafting or in the treatment of atrophic mandible fractures.

In the pre-operative and post-operative periods antibiotic therapy is used which is implemented on the day the patient is admitted to hospital; most often it is intravenous amoxicillin 1.2 x 2 or intravenous clindamycin 0.6 x 2. Standard anti-oedema and analgesic treatment as well as 6-week soft diet are used in the post-operative period.

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After discharge from hospital the patient is treated on the outpatient basis during follow-up visits every week conducted for 6 weeks or in case of complications until complete union of bone fragments is achieved. Intramaxillary immobilization is removed after 3 or 6 weeks depending on the recommendations, whereas miniplates are qualified for removal inthe event of complications in the form of exposure, loss of stabilization or inflammation.

The study was retrospective. In the years 2000-2018, 1716 patients diagnosed with mandibular fracture were treated at the Maxillofacial Surgery Ward of the Radom Specialist Hospital. Data were obtained from routine medical records: medical history of the Ward and the Hospital Outpatient Clinic. Correct and complete data were collected in 611 disease histories. Among the patients there were 541 men and 70 women. The follow-up period after fracture repairwas up to 3 years. During this period, i.e. after 6 months to 3 years, 224 patients were examined.

The variables analysed included demographic data, circumstances of the injury, location of the injury, accompanying injuries, comorbidities, early and late complications and functional assessment of the masticatory apparatus.

OUTCOMES:

Among the examined group of patients there were 452 men (88%) and 58 women (12%).

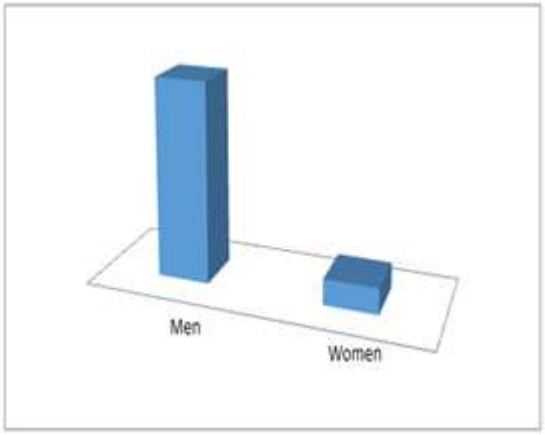

Fig 4- Quantitative distribution based on gender in the examined group

In 63% of cases a tooth accompanied the line of fracture and in 37% no tooth was found in the fracture fissure.

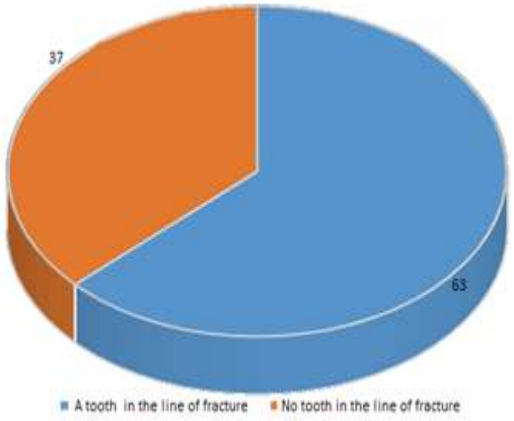

Fig 5 - Diagram illustrating the number of fractures with concomitant tooth in the line of fracture

In the analysed material the patients with mandibular fracture had also concomitant injuries, such as fractures of other skull bones, which is illustrated in the diagram below.

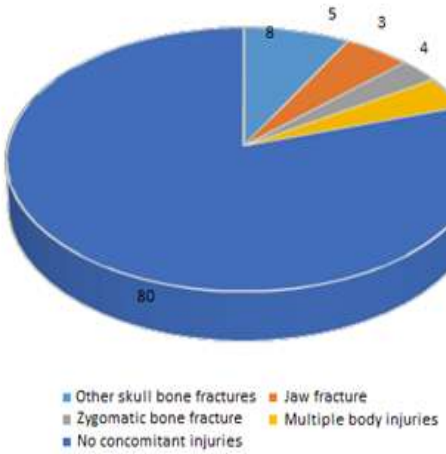

Fig 6 – Distribution of concomitant injuries in patients treated at the Maxillofacial Surgery Ward (%)

Early complications occurring after surgical treatment of mandibular fracture were analysed which is illustrated in the diagram below.

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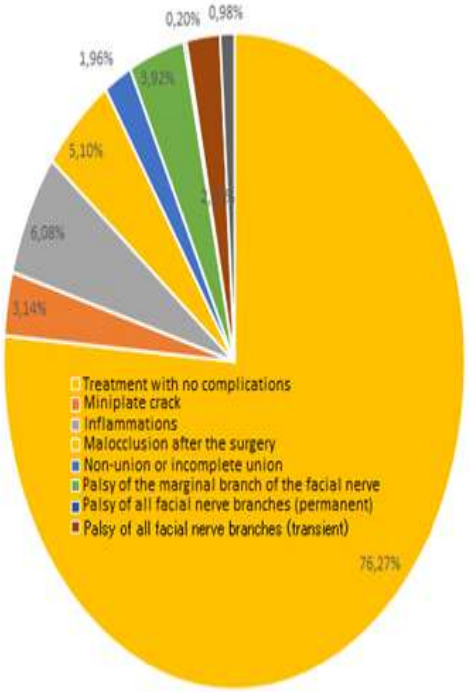

Fig 7- Diagram illustrating distribution of post-operative complications of mandibular fracture management based on the types of complications in patients treated at the Maxillofacial Surgery Ward (%)

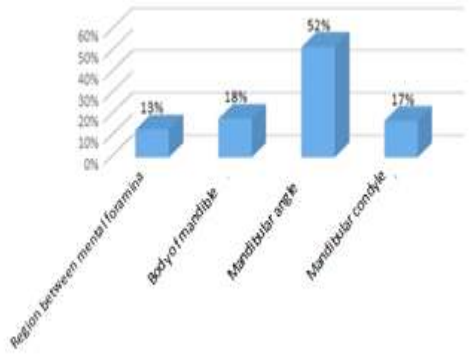

Fig 8 - Diagram illustrating distribution of post-operative complications of mandibular fracture management based on the location in patients treated at the Maxillofacial Surgery Ward (%)

Late complications are depicted in the diagram below. The period analysed was from 6 months to 3 years counting from the end of the hospitalization process.

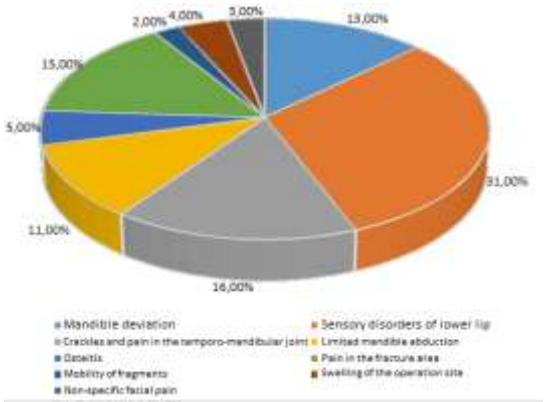

Fig 9 - Diagram illustrating the incidence of late complications of the surgically managed mandibular fracture in patients treated at the Maxillofacial Surgery Ward (%)

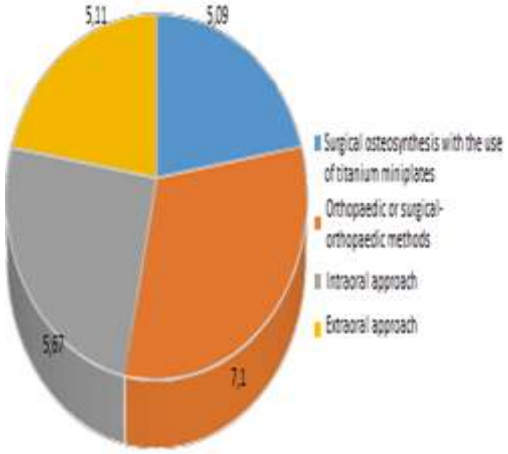

Fig 10- Average time of hospitalization at the Ward based on treatment methods

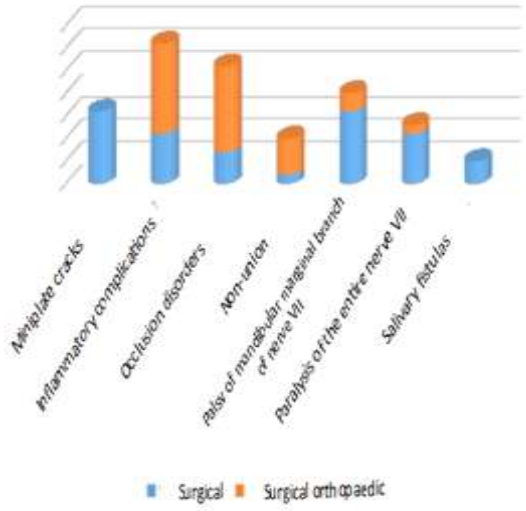

Fig 11- General frequency of the early complication incidence based on treatment methods

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In general, surgical osteosynthesis was connected with lower incidence of complications than the other two mandibular fracture treatment methods. The complications were also different in nature. Statistical analysis showed that a lower number of complications noted in the case of surgical osteosynthesis when compared with orthopaedic or surgical-orthopaedic procedure was statistically significant as regards inflammatory complications and malocclusions. What is more, it was proved that in comparison to osteosynthesis, inflammatory complications or late complications occurred significantly more often after the application of orthopaedic methods or surgical-orthopaedic procedures.

Sixty-three per cent (63%) of all complications occurred in case of comminuted fractures, whereas 37% were seen in single fractures. Early complications occurred in all anatomic regions of the mandible, however, with different frequency.The least number of complications was noted in the submental region. Here the typical complication was wound dehiscenceand exposure of miniplates. Inflammatory complications, non-union, malocclusion, miniplate crack were typical of the corpus of the mandible fracture. Mandibular angle fracture often caused a malocclusion, miniplate crack, loosening of the fixing system, palsy of the marginal mandibular branch of the facial nerve (in extraoral approach). Salivary fistulas, malocclusion and facial palsy were observed in cases of the condylar process fracture.

Next, a distribution of late complications was analysed in sub-groups identified by treatment methods.

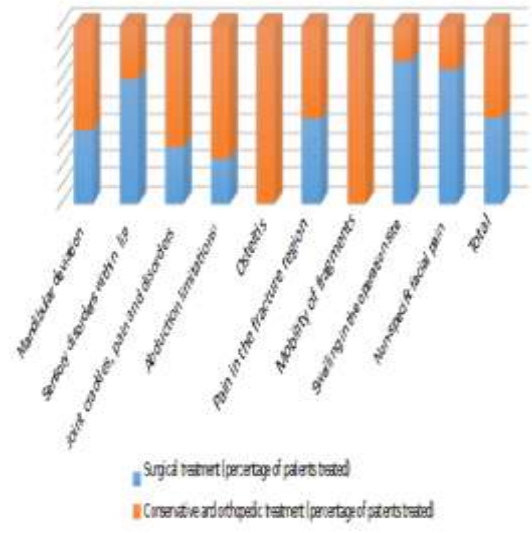

Fig 12- Late complications by gender

Late complications in the group treated by conservative orthopaedic or mixed methods were statistically more frequent.

Moreover, it was proved that early complications including inflammatory ones and late complications were significantly more frequent after treating mandibular fractures with conservative orthopaedic or mixed methods.

Analysis of other factors which can affect the occurrence of complications let us find out that these were chronicsystemic diseases, alcoholic intoxication during the injury and addiction to alcohol.

II. DISCUSSION OF RESULTS

In the years 2000-2018, 1716 patients diagnosed with mandibular fracture were treated at the Maxillofacial Surgery Ward of the Radom Specialist Hospital. Correct and full data were collected in 611 medical histories. Among the patients there were 541 men (88%) and 70 women (12%). Quantitative prevalence of men in the study may be the result of their higher aggressiveness, more frequent participation in fights, faster car driving or driving other means of transport and exercising sports. It refers, in particular, to male population in the age range of 21-30 years. The average age of men with a fractured mandible was 34 years; for women it is almost 12 years higher.Other authors also draw attention to high prevalence of men in comparison to women, on average at a 5:1 ratio, with the highest prevalence of men in the second and partly third decades of life [1, 5, 27, 33, 50, 55, 60, 75, 78]. In other studies this ratio is higher and stands at 7.4:1 [32], or even 19:1 [18,19].

Mandibular fracture in children occurs less often than in adults. Proportions between boys and girls are at the level of 2:1, with the highest number of injuries at the age of over 13. This fact can also be explained by a greater mobility of male children at this age and, first of all,exercising sports by boys at this age. Sports injuries and traffic accidents, and falls in the case of small childrendominate among the causes of fractures in this age bracket [29,70].

In the analysed material, the most frequent causes of injuries were: fights (71%), traffic accidents (15%), falls (6%), accidents at work (2%), sports accidents (3%), epileptic seizures (1%), other causes (2%).Similar results were also obtained by other authors [5, 32, 55, 60, 75].

In some studies traffic accidents prevail and fightsare next in line [27, 50]. It may result from industrialization of the region in which the study was carried out. In his publications Ellis

mentions fights (71%) as the first cause of mandibular fracture and, in his opinion, fractures on the left side (64%) are the result of the right-handedness of population [18, 19].

A relevant factor affecting the incidence of complications is the time of coming to hospitals. Among the post-traumatic patients, 28% of those with a fractured mandible came to hospital on the first day, 49% - in the first week, 12% - in the second week and 6% - in the third week. Five per cent (5%) came even later than that. Women are quicker than men in contacting health care institutions.

All authors agree that the time of reporting to hospital is very important for the formation of complications, especially inflammatory complications and they also agree that mandibular fractures should be operated as quickly as possible [18, 19, 58, 59]. Some researchers claim that a 72-hour delay does not affect the formation of inflammatory complications [32, 44, 78].

In the analysed material, majority of mandibular fractures were comminuted fractures (61%) whereas single fractures constituted only39 %. It is consistent with reports from other centres [1, 5, 32, 55].

Most often the fracture fissure was located in the region of the mandible angle (29%), then in the regionsof premolars (20%), canines (19%), mandibular condyle (14%), mental tubercle (2%), molars (4%) and mandibular branches (2%).

Majority of publications confirm the highest number of fractures in the mandibular angle, the second in line is the submental segment[27, 32, 50, 60, 61, 78]. In our research the second position is taken by the segment corresponding to premolars. Different quantitative distribution of the mandibular fracture locations can be caused by the population-related factors, namely, it may depend on population density [61].

The study assessed also additional features of mandibular fracture such as fractures with fragment displacement which constituted 78%, whereas fractures without displacement constituted 22%. Majority, i.e. 97% of cases, concerned toothed jaws and 3% - edentulous jaws.

Treatment of mandibular fractures with anodontia in ca. 20% results in complications [45, 51, 73, 77] due to specific different anatomic and physiological conditions most often connected with the age of the patients suffering from anodontia.The loss of teeth is followed by reduced bone mass in mandibles and the way of its vascularization is changed. No longer does the inferior epigastric artery passing over the mandibular canal play the main role in mandibular vascularity, the bone is mainly fed by periosteal vessels. The cancellous bone amount is reduced and as a result mandibular flexibility and tendency to regeneration are decreased. This hasan adverse effect on the mandible's resistance to injuries and also disturbs healing of fractures and increases the number of complications [6, 23, 69].

The presence of a tooth in the fracture fissure is an important problem accompanying mandibular fractures and possibly affects susceptibility to the formation of complications. It can contribute to inflammations, both early and late and, to some degree, can have an effect on the proper union of bone fragments during a surgery.Among the patients examined, in 63% of cases a tooth accompanied the line of breakage, in 37% of cases no tooth was found in the fracture fissure.It is quite clear how to cope with a tooth in the fracture fissure in the corpus of the mandible and, if it is a vital tooth, the root is not quite exposed and the tooth does not pose a difficulty in reposition of fragments, then majority of surgeons adopt a wait-and-see attitude and do not extract such a tooth during a surgical procedure [50, 55].

The attitude is less obvious in the case of the impacted wisdom teeth whose presence in the bone predisposes the mandibular angle to fracturescaused by the bone mass weakening ("locus minoris resistentiae"). Majority of comparisons and studies concerning this issue do not answer a question whether removal of wisdom teeth from the fracture fissure reduces the number of inflammatory complications [18, 19].

Some surgeons believe that the impacted wisdom toothcan be left in the fracture fissure because it contributes to the proper union of bone fragments (naturally it refers only to the teeth which are completely impacted), yet majority of doctors remove impacted wisdom teeth from the fracture fissure, either during the osteosynthesis surgery or later after obtaining a complete union of bone fragments [4, 9, 21, 43, 48, 56].

In the analysed material the patients with mandibular fracture experienced also concomitant injuries, such as fractures of other skull bones (8%), jaw fractures (5%), zygomatic bone fracture (3%), multiple body injuries (4%). No concomitant injuries were found in 80% of patients.

Soft tissue injuries accompanied mandibular fractures in 70% of cases, and loss of consciousness in 15% of cases.Statistically fewer additional injuries were found in women and in case of women the loss of consciousness was less frequent.In the available literature on the subjectthese values looked different and they were not consistent with our own study.Different

distribution of accompanying injuries, especially severe multifocal and multi-organ injuries, can be caused by the location of the hospital in the neighbourhood of large urban agglomerations or highways [50, 55, 60].

Concomitant systemic diseases are an important factor affecting the incidence of complications. In our own study 12% of patients suffered from additional diseases.They included heart diseases, hypertension, diabetes, liver and kidney diseases, bronchial asthma and epilepsy. In literature authors also emphasise a big roleof systemic illnesses in development of complications [32, 60].

Addiction to alcohol and cigarettes and how it contributes to the development of complications in mandibular fracture treatment was also the subject of our study. The patients who were under the influence of alcohol at the moment of injury constituted 25% of cases whereas the patients chronically addicted to alcohol and cigarettes constituted 65%. A statistically significant relationship between the rate of complications and addictions was found. The data from literature confirm a strong relationship between these variables [37, 50].

The patients addicted to alcohol, medicines and drugs are more likely to get injured which is connected with the use of violence.As a rule they get to hospital with some delay, they poorly control chronic diseases like diabetes and heart diseases. It was noted that inflammations and lack of bone union after mandibular fracture treatment are more common in such patients[32]. Nutritional deficiencies, lifestyle, poor hygiene, non-compliance with medical recommendations and therapeutic regime are the main causes of worse healing of bone fractures in addicted patients [26, 32, 55]. Application of antibiotic therapy in this group of patients does not protect against complications the rate of which reaches 20%, and in re-operations - almost 22% [32].

According to Sauerbier alcohol and cigarettes in medical history, concomitant mandibular condyle fracture, pre-operative malocclusion and odontogenic infections are the greatest risk factors in mandibular fracture treatment [60].

Among all the patients examined in that period surgical treatment was applied in 78% of casesand surgical-orthopaedic treatment in 22% of cases.

In the years 1988-1997 at the Dental and Maxillofacial Surgery Clinic in Lublin a similar study was carried out on the comparable number of patients but the results obtained were different: 60% of patients were treated with the use of the orthopaedic method, 18% with the use of surgical method and 22% - with the use of a mixed method, i.e. surgical-orthopaedic method. This proves that orthopaedic methods are gradually abandoned in favour of surgical methods and this has happened in our country at the turn of the 20th and 21st century [78].

Our own study showed a relationship between the treatment applied and the occurring complications. Application of orthopaedic treatment or surgical-orthopaedic treatment increases a possibility of inflammatory complications. It also increases the average time of patient's hospitalization from ca. 5.08 days for surgical treatment to ca.7.09 days for orthopaedic treatment.

Surgical methods cause fewer complications than orthopaedic ones and significantly reduce the time of treatment and post-operative inconvenience [34, 50].

Mixed methods, i.e. application of additional intermaxillary immobilization, are not justified in modern studies [10, 39, 44].

An important factor is also reduction of masticatory force occurring after the injury and bone fractureto 30% for the period of 6 weeks, and the studies comparing the masticatory force at closed repositions in relation to the open surgical reposition do not indicate any differences in this respect [13, 20].

In the analysed material complications were noted in 23.73% of cases, including 3.14% of miniplate cracks, 6.08% of inflammatory complications (wound dehiscence, osteitis, loosening of the fixing system), 5.1% of malocclusions after the surgery or lack or incomplete union (1.96%), 3.92% of palsies of the marginal mandibular branch of the facial nerve, paralyses of all branches of the facial nerve – permanent (0.2%), temporary (2.35%) and salivary fistulas (0.98%).

Similar data concerning post-operative inflammations and malocclusions are also given in other publications [30, 32, 42, 50, 52]. Some studies show the relationship between inflammatory complications and miniplate damage, removal of a tooth from the fracture fissure, use of compression plates or insufficientrigidity of osteosynthesis [50]. However, no relationship was shown between the occurrence of infections and the use of antibiotics. Post-operative malocclusion can depend on dental condition and the type of fracture as well as improper positioning of bone fragments by the operating person [58, 59].

The type and intensity of early complications is connected with fracture location in the mandibular bone.In our research the smallest number of complications (13%)concerned the region between mental foramina and most often these arewound dehiscence and exposure of miniplates. Ca. 18% of early complications are located in the corpus of the mandible and most often they are osteitis,non-union, malocclusion or a miniplate crack. The mandibular angle is the region where most complications occur (52%).Most frequently they include: malocclusions, miniplate cracks and exposure, loosening of the fixing system, palsyof the marginalmandibular branch of the facial nerve. Ca. 17% of complications concern the mandibular condyle treatment and most often these are: salivary fistulas, malocclusion, temporary and permanent palsy of the facial nerve trunk or branch.

According to the study by Jędrusik-Pawłowska the most accurate union during osteosynthesis is achieved in the region of union, and the least accurate on the mandibular condyle . It is the effect of good operational visibility in the submental segment and precision of the union results in a lower rate of complications. However, to eliminate torsional forces resulting frommuscular actions in the submental segment two miniplates should be used, one over the other, the distance between them should be at least 1 mm and the lower one should be fixed first.If we operate on a comminuted fracture, the submental segment should be managed first and then the mandibular angle to achieve a proper occlusion [58, 59].

Champy's research led to identification of several zones in the anatomical course of the mandiblein which osteosynthesis principles are similar. The first zone is between mental foramina where strong forces bending and turning fragments appear. To prevent such forces one should put two miniplates in this place, one over the other. The second "neutral" zone is located below the tooth roots of the lateral part of the mandible and osteosynthesis with one miniplate allows stabilization of bending forces. The third zone is the area of the retromolar triangle and mandibular angle where fracture stabilization is provided by one miniplate applied on the lateral surface along the course of the external oblique line.Another zone is the region of mandibular branches and condyle where, as a rule, we apply two miniplates [78].

While repairing fractures in the first three zones, most frequently we choose the intraoral route of accessapart from the cases of soft tissue wounds or inflammatory complications. Mandibular branches and condyle are most often approached through the extraoral route.

General principles of osteosynthesis are common for all mandibular segments and following them guarantees operational success:at least 2 -3 screws should be placed in every fragment, the drill should be inserted perpendicularly to the bone surface;during hole drillingoverheating of bones should be avoided and a hole must be several tenths of millimetre smaller than the screw. It must be remembered that the thickness of the cortical bone is by ca. 3mm largerin the mental region and the region of oblique line. Implants produced by two different companies should not be used and miniplates should not be connected with a surgical wire because a redox reaction increases the incidence of inflammatory complications. To avoid damage to tooth roots, the miniplate should be positioned below the expected course of tooth roots and appropriate screw length should bechosen. A miniplate should be placed on the bone passively and without compression[30, 58, 59, 72].

Treatment of the mandibular angle fractures causes the highest number of complications among mandibular fractures [18, 19]. In the examined materialthe rate of complications related tothe mandibular angle fractureamounted to52%.

In the available literature this value fluctuates between 30-60% [10, 27, 67]. The most frequent complications inthe mandibular angle fracture region are exposure or crack of miniplates, malocclusions, inflammations and palsy of the marginal mandibular branch of the facial nerve. Inflammations most often appear during the intraoral approach and palsy of the marginal mandibular branch of the facial nerve during the extraoral approach. The intraoral route is more difficult to achieve proper repositioning of fragments, place a miniplate on the bone and angulate the screw.Therefore the best approach to the mandibular angle is through the intraoral route with the use of the transbuccal trocar. This method combines advantages of both access routes and practically it entails no complications. It significantly reduces the time of the procedure, is technically simple, does not leave scars on the faceand, first of all, allows placement of a miniplate according to Champy's principles [3, 25, 30, 75, 77].

In the surgical treatment of mandibular angle fractures there are three trends. The first one can be classified as rigid fixation, i.e. osteosynthesis with the use of one rigid miniplate and bicortical screwsor two smaller miniplates. The purpose of such fixation is complete elimination of

movements in the fracture fissure during mastication.

The second trend is represented by such surgeons as Michelet and Champy who believe that a single non-rigid miniplate placed along the upper edge of the mandible is enough (the so-callednon-rigid functionality).

The third trend assumes that the best method of the mandibular angle fixation isa bonesuture and several week-long intermaxillary immobilization [25, 25, 72].

The research by Ellis proves that the complication rate is at its lowestat non-rigid half-functional fixation with one miniplate situated on the lateral surface of the mandibular angle, below and along the oblique line of the mandible put through the intraolar route of access [8, 18, 19, 22, 43, 44, 73]. Placing of the second miniplate increases the "mass effect" and complications in the form of miniplate exposure and wound dehiscence are more frequent [18, 19].For this reason some surgeons prefer osteosynthesis of the mandibular angle with the use of miniplates [13].

These principles refer to single fractures with proper support in lateral segments of the mandible. In the event of fractures with significant displacement of fragments, the presence of an indirect or crumbled fragments, comorbidant inflammation, in the case of atrophic mandible treatment, re-operations and non-united fractures the best method of treatment is rigid fixation with the use of several miniplates or even reconstruction plate through the extraoral route of access [19, 25, 30, 37]. The most frequently used extraoral approach is the Risdon submandibular approach (2-3cm below the lower mandibular edge). The only disadvantage of this approach is a complication in the formof neuropraxia of the marginal mandibular branch of the facial nerve which innervates the muscles:depressor anguli oris,depressorlabii inferioris, bottom fibers of orbicularis oris andmentalis. Most often it is transitory but, nevertheless,annoying for the patient.Some surgeons report in their studies a lowerincidence of neuropraxia of nerve VII using the approach without identification of the marginal mandibular branch which consists in a downward cut_owards the submandibular gland than in the case of a standard cut with flap elevation[35].

Sensory disturbances of the inferior alveolar nerve is difficult to monitor as a complication because it is difficult to determine whether it results from the injury or surgery.However, with conservative treatment sensory disorders of the alveolar nerve are lesser, therefore one must be very careful while uniting the fracture in the area of submental foramen [8, 63].

The materials used for osteosynthesis do not have much impact on the occurrence of complications. Studies do not show any differences whether we use resorbable materials or different types of miniplates [14, 40, 49]. Using internally blocked platespreventsthe formation of forces between a screw head and a plate, causes increased rigidity of the whole structure and may reduce the number of complications related to the transmission of mastication forces to the miniplate. It also reduces pressure of the plate on the bone which results in larger blood supply [26, 60, 64].

The loss of a bone fragment requiring a reconstructive surgery is a significant complication after the mandibular alveolar process treatment. When there is no possibility of intermaxillary immobilization, an open surgery with flap elevation and performance of micro- or miniplate osteosynthesis often ends in necrosis and loss of the whole fragment together with teeth.

Osteosynthesis with the use of several long flapless bicortical screws can be a solution to the problem [53].

In our material mandibular condyle fractures constituted 14% of all mandibular fractures. In the available literature this value fluctuates between 15% and 50% [2, 7, 11, 15, 17, 24, 38, 41, 76]. The route of surgical access is most important for the occurrence of complications in surgical treatment of the mandibular condyle and, in particular, the occurrence of the worst of them, i.e. facial nerve palsy. We distinguishsuch extraoral routes of access as:submandibular, transsalivary, retromandibular, preauricular, postauricula and coronal,and intraoral.A disadvantage of extraoral access routes is a higher risk of the facial nerve palsyand a skin scar; intraoral access does not cause these complications. Yet, a lot of data from literature concerning osteosynthesis of the mandibular condyle from the intraoral access point to lower quality of the anatomically correct, three-dimensional closing of fragments, which in the future may result in malocclusions, myofascial pain, facial asymmetry and re-sorption of the condylar head [11,62]. It is certainly connected with a great technical difficulty of intraoral surgeries, lower visibility and smallsurgical field. The transsalivary approach and retromandibular approach areused in treatment of fractures of the condyle neck and superior 1/3 of the mandibular branch. In both approaches placing the upper screw and its angulation are very difficult. The transsalivary approach is slightly better in this respect than the retromandibular

access.Transbuccal guide bars can also be used to this end [31].

Retromandibular access eliminates salivary complications such as: Frey's syndrome, salivary fistula and sialocele. It is relatively safe for the facial nerve, characterised by good visibility and easy osteosynthesis [11, 66, 74]. Nevertheless, some authors describe as many as 30% of cases of temporary facial nerve weakening as well as individual cases of the great auricular nerve palsy, permanent facial nerve palsies and sialocele [41, 46]. The submandibular access does not cause complications in the form of permanent nerve VII palsy, but a more difficult operational access and more difficult 3D adjustment of fragments cause more complications in the form of malocclusionsand facial asymmetry . The preauricular access is preferred in patients with very high fractures and short condylar necks of the mandible, the preauricular and post-auricular approaches are applied for intracapsular fractures and high condylar neck fractures. The coronal approach is rarely used when we deal with other existing indications [46]. The best method of the mandibular condylar fracture osteosynthesisis stable, rigid miniplate ostesynthesis, yet one must realize the occurrence of complications caused bynon-anatomical union of fragments. Inaccurate closing of the mandibular condyle bone fragments causes their improper 3D positioning and improper position of the mandibular head in "glenoid fossa", which later results in a change in muscular tension and consequential changes in the temporo-mandibular joint and hence mandibular head resorption [2]. Many authors believe that the least number of complications is caused by the anatomically rigid union of the condyle through the extraoral access in the correct 3D position without releasing the lateral pterygoid muscle [16, 36, 54].

Accurate intraoperative positioning of the condyle in all three dimensions depends, to a large extent, on access route and visibility during the procedure.Proper re-positioning of bone fragments determines precise performance of osteosynthesis which aims to keep the broken condyle in spatial configuration, as close as possible to the anatomical bone arrangement before the injury. Osteosynthesis of bone fragments must also oppose mastication forces and muscular forces for at least 6 weeks, i.e. until the complete union occurs. Numerous studies on this issue showed that placing a single miniplate on the condyle is not enough; two rigid miniplates should be placed, one along the posterior edge of the mandibular branch and the other one closer to the mandibular notch. It is more difficult from the technical point of view and demands bigger tissue delamination. The relatively easiest way to achieve this is using the transsalivary access route [31,57]. Further studies led to the production of 3D miniplates specially intended for the mandibular condyle fractures. Ellis compared facial symmetry in patients treated with open and closed re-positioning of the mandibular condyle and stated that treatment with the closed non-operative methodresults in greater loss of the facial height and greater angulation of the broken mandibular condyle than in the open method [19, 28, 47, 76].

In another study conducted for 6 years on a group of 204 patients treated exclusively with surgical methods, the same author assessed the impact of the access route to the mandibular condyle on the rate of complications. He studied complications related to the facial nerve immediately after the operation and in a more distant time, facial symmetry, functions of the joint and complications within the joint, occlusion conditions and condyle re-modelling. Temporary facial nerve weakening occurred in ca. 10% of patients and paradoxically it was related to the submandibular approachwhich, in turn, may have been connected with tissue stretching. No relationship was noted between this complication and the degree of the condyle displacement, although it may seem that during the surgery the displacement degreecauses greater neuropraxia and axonotmesis. In Ellis' study permanent facial nerve palsy according to the Hause Brekman Facial Nerve Grading System occurred in 4% of cases.Complications in the form of an overgrown scar during the retromandibular approach was observed in 7% of casesbut, in his opinion, the most visible and noticeable scars appearafter the submandibular access. Ellis observed also the formation of salivary fistulas but he associated them only with improper, untight stitching of the parotid facia. Significant re-modelling of the condyle appeared in 7% of patients and moderate resorption with head flattening appeared in 16 % of patients. A big re-structuring of the condyle is connected with reduced mouth opening [19, 20].

In the past it was believed that resorption of the condyle is related to unduly lengthy immobilization. Contemporary research does not confirm this, however, the useof the intermaxillary elastics, for example in the situation of concomitant mandibular body fracture can intensify problems with the temporo-mandibular joint [12]. At present majority of studies confirm the theory that the greatest impact on the formation of the condylar head necrosis

has correct, 3-dimensional positioning of bone fractures and maintaining blood supply to it which practically is synonymous with retentionof the lateral pterygoid muscle attachments [28].

Most observations of the surgical treatment of the condylar fracture performed with stable miniplate osteosynthesis through the etraoral approach confirm our conclusion thatthe most frequent complications include temporary facial nerve palsy, salivary fistula and malocclusions. Klatt assessed mandibular fractures with condyle fracture Class 2 and 4 according to Spiessl and Schrollclassification operated through the transsalivary approach by the stable miniplate osteosynthesis. While analysing 48 patients (16 women and 32 men), he noted temporary facial nerve atonyin 10% of them, malocclusions appearing 6 months after the surgical procedure in 16% of cases, hearing difficulties and vestibular sensitivity in 16%, and salivary fistulas in 4% of them [17, 38].

Not all of these complications which occur in the mandibular fracture treatment make us consider re-operation. In our material the number of re-operations reached ca. 7%. Most often the re-operations were undertaken due to lack of union or incomplete union, malocclusion, miniplate crackor inflammations. Other authors reveal a similar number of re-operations [18, 60, 61], and sometimes it is higher reaching even 16-20% [19]. In some centres wherethe removal of internal fixation is a standard procedure, the number of re-operations can be lower because it is difficult then to qualify miniplate exposure or loosening of the fixation system as a complication.

The observation period after fracture management was up to 3 years.In that period, i.e. 6months to 3 years, 187 patients were examined.

Mandibular deviation was observed in 13% of patients, sensory disturbances within the lower lip in 31%, crackles and pain in the temporo-mandibular joint in16% and mandibular abduction limitations – in 11%. In our study we also observed osteitis in 5% of patients, pain in the fracture region - 15%, mobility of fragments – 2%, oedema in the surgical site - 4% and non-specific facial pain in 3% of cases. Late complications more frequently occurred in men and statistical relationship was found betweenlate complication and early inflammations. Also systemic diseases and alcohol and cigarette addiction influenced the occurrence of late complications.

III. CONCLUSIONS:

1. Surgical osteosynthesis of mandibular fragments is a method with lower incidence of both earlyand late complications compared to conservative orthopaedicor mixed methods and is also associated with shorter hospitalization of patients in the ward.
2. Majority of complications in the mandibular fracture treatment occur around the mandibular angle.
3. Complications of mandibular fractures are more frequent in patients suffering fromsystemic diseases and those addicted to alcohol.
4. Inflammatory complications predominate in conservative-orthopaedic treatment.
5. The occurrence of inflammatory complications in the early period significantly increases the risk of developing late complications.

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