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New trends and insights in facial fracture treatment in the United States

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Abstract

Aim: Facial fractures have multiple etiologies, including motor vehicle collisions, interpersonal violence, falls, and sports-related accidents. The objectives of this study are to reassess, compare, and expand the epidemiologic analysis and postoperative complication rates of facial fracture treatment. Additionally, we sought to compare the length of stay and operative time outcomes between plastic surgeons and non-plastic surgeons.

Methods: NSQIP (National Surgical Quality Improvement Program) participant databases were queried to identify all patients undergoing facial fracture operations. Epidemiological data was divided into two groups and compared by surgeon specialty: patients operated on by a plastic surgeon and patients operated on by a non-plastic surgeon. Our primary outcomes of interest were operation time and length of stay. Postoperative complications included wound complications, mortality, return to the OR, and major bleeding.

Results: 3,354 patients underwent facial fracture repair (2012 to 2016). In men, the most common fracture was mandibular (40.9%); in women, the most frequent was orbital (32.4 %). 79.6% had single facial fractures and 20.4 % had multiple facial fractures. Plastic surgeons' operating time was less than that of non-plastic surgeons (P = 0.0007). The average length of stay was higher for the plastic group (mean = 1.65 days, plastic) (P < 0.00001). Postoperative complication variables showed no statistically significant differences between the plastic and non-plastic groups.

Conclusion: Continuous epidemiologic analysis is vital for the proper allocation of healthcare resources to the most affected facial fracture patients in the US. Assessment of complication rates between surgical specialties allows a better understanding of the management of facial fracture patients on a national level. Our data analysis may allow surgeons to better counsel patients preoperatively and improve inter-specialty collaboration.

Keywords: Craniofacial, trauma, plastic surgery, population

INTRODUCTION

Facial injury is common in trauma patients and costs an estimated $1 billion in emergency department (ED) visits annually[1]. The evaluation of facial injury involves prompt diagnosis of facial bone fractures, in addition to soft tissue injury. On average, facial fracture patients admitted directly from the ED had higher hospital charges and longer hospital lengths of stay compared to those admitted as outpatients after evaluation and discharge from the ED[2]. Facial fractures have a variety of etiologies, including motor vehicle collisions, interpersonal violence, falls, and sports-related accidents[3]. Facial fractures can be treated by multiple surgical specialties, including plastic surgery, otolaryngology/ENT, Oral & Maxillofacial Surgery, and orthopedics[4].

Previous studies have investigated trends in demographics, treatment, and postoperative complications in facial fracture patients[5-16]. but most of these studies are based on a single institution or region. Currently, very little research exists on nationwide facial fracture treatment. In fact, only one such study has been done to date, using the American College of Surgeons National Surgical Quality Improvement Program (ACS NSQIP) between 2005 and 2011[4]. However, the limited number of hospitals participating in the ACS-NSQIP database between 2005 and 2011 yields a small data sample which presents a significant limitation to results and interpretation. In fact, the number of participating hospitals in 2011 was only 315 compared to 680 in 2016, increasing the number of logged cases from 1,222,034 (2005 to 2011) to 3,832,117 (2012 to 2016)[17]. Furthermore, since 2011, the ACS-NSQIP introduced new variables such as Present At Time Of Surgery (PATOS) to eliminate postoperative morbidity events present preoperatively as well as unplanned reoperation specifically related to the original or concurrent procedure, and considered three outcome variables (graft failure, coma, peripheral nerve injury) inaccurate for years 2010 and 2011[18]. These changes warrant a new assessment of the postoperative complications in the treatment of facial trauma patients. Hospital length of stay, operation time, and complication rates are essential determinants for the increasing cost of facial trauma treatment[2]; assessment of these variables on a national level and by surgical specialties may guide physicians to treat facial fractures in a cost-effective manner.

The objectives of this study are to reassess, compare, and expand the epidemiologic analysis and postoperative complication rates of facial bone fracture treatment using the ACS-NSQIP database between 2012 and 2016, representing a three-fold increase in the patient database with a wider geographical representation. ACS-NSQIP is a well-validated database that prospectively collected perioperative data from multiple institutions throughout the United States[18]. With the addition of an up-to-date and significantly larger database, we confirm previously established trends while providing new insight into current management conditions for facial fractures, post-surgical complications, and performance by surgical specialty.

METHODS

Patient selection

The 2012 to 2016 ACS NSQIP participant databases were accessed on April 1st, 2018 and queried to identify all patients undergoing facial bone fractures operations. Table 1 shows the Current Procedural Terminology (CPT) codes used to identify patients with facial bone fracture operations. CPT codes were grouped by

Table 1. Current procedural terminology codes

Maxilla fracture	Mandibular fracture	Nasal bone fracture	Frontal sinus fracture	Orbital fracture	Zygoma fracture	Zygomaticomaxillary complex	Alveolar ridge
Le Fort I	21450	21310	21343	21385	21356	21365	21440
21421	21451	21315	21344	21386	21360	21366	21445
21422	21452	21320	21338	21387			
21423	21453	21325	21339	21390			
Le Fort II	21454	21330	21340	21395			
21345	21461	21335					
21346	21462	21337					
21347	21465						
21348	21470						
Le Fort III							
21431							
21432							
21433							
21435							
21436							
Additional Procedures:							
Open treatment of nasal septal fracture, with or without stabilization							21336
Open treatment of fracture of orbit, except blowout; without implant							21406
Open treatment of fracture of orbit, except blowout; with implant							21407
Percutaneous treatment of fracture of malar area, including zygomatic arch and malar tripod, with manipulation							21355
Closed treatment of temporomandibular dislocation; initial or subsequent							21480
Complicated (e.g., recurrent requiring intermaxillary fixation or splinting), initial or subsequent							21485
Open treatment of temporomandibular dislocation							21490
Interdental wiring, for condition other than fracture							21497

Table 1 shows the codes used to identify patients undergoing facial bone fracture operations. Codes are sorted by fracture location, as listed in the CPT 2015 manual. Additional CPT codes were added for completeness, as these CPT codes were not classified with the other fractures by location.

anatomical location for analysis. Of the patients undergoing facial bone fracture treatment, 158 patients were excluded to avoid biased outcomes and false complication rates due to concurrent procedures in non-facial areas or to facial bone fixation procedures after osteotomy for head and neck tumor extirpation. Excluded patients were identified using the postoperative diagnosis codes 9 and 10 (ICD 9 & 10). Patients were sorted into a single-facial-fracture group and a multiple-facial-fractures group. In a different analysis, patients were sorted into a plastic surgery specialty group and a non-plastic surgery specialty group. The American Society of Anesthesiologists (ASA) classification, quarter of admission, transfer pattern, surgical specialty, body mass index, diabetes mellitus, hypertension, smoking, functional status, and demographic data were collected and analyzed for each gender group and type of facial fractures in both single and multiple-fractures groups as well as for plastic and non-plastic surgery groups (ENT, orthopedic surgeon, general surgeon, neurosurgeon, vascular surgeon, and urologist).

Surgical specialty

Patient epidemiological data was divided into two groups and compared based on the specialty of the surgeon: patients operated on by a plastic surgeon and patients operated on by a non-plastic surgeon. Furthermore, patients with postoperative complications were divided into two groups and compared based on the specialty of the surgeon as previously stated [Figure 1]. Ophthalmologists, oral & maxillofacial surgeons are not included in the ACS-NSQIP database.

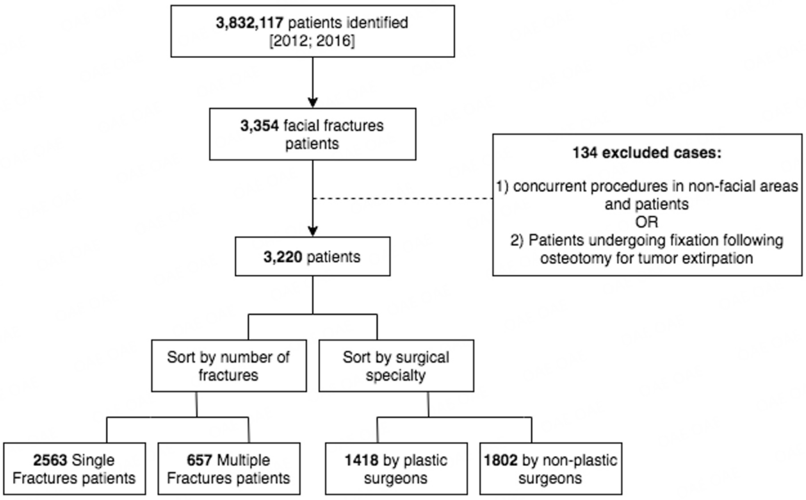

Figure 1. Patient-selection process. From years 2012 to 2016, the ACS-NSQIP contained 3,832,117 cases from different area hospitals in the United States. Of those, 3,354 patients underwent facial fractures treatment.

Outcome and postoperative complications

Complications analysis was made for single/multiple facial fracture groups and plastic/non-plastic groups. Our primary outcomes of interest were operation time and length of stay. Postoperative complications included wound complications, mortality, return to the operating room, and major bleeding. Surgical complications were defined as any wound infections, acute wound dehiscence, graft failure, and need for intraoperative blood transfusion. Medical complications included any defined ACS-NSQIP nonsurgical endpoint, such as pneumonia, pulmonary embolism, postoperative renal insufficiency (creatinine > 2 mg/dL), urinary tract infection, stroke, myocardial infarction, symptomatic deep venous thrombosis, or sepsis. Complications were treated as a dichotomous variable (none *vs.* one or more). All complications were identified within 30 days of the index procedure.

Statistical analysis

Bivariate analysis was used for epidemiologic and postoperative variables. The *t*-test was used for continuous variables and the Chi-square test or Fisher's exact test was performed to compare categorical variables. All statistical analyses were performed using R software version 3.4.4 (http://www.R-project.org) with a statistical significance set at the alpha value of 0.05.

RESULTS

A total of 3,354 patients underwent facial fracture repair between 2012 and 2016. Mandibular fractures were the most common among all facial fractures [Figure 2]. Most male and female patients were in their twenties [Figure 3]. The types of fracture within each sex group and ethnicity were distributed differently: in men, the most common fracture was mandibular (40.9%), and in women, the most frequent was orbital (32.4%) [Figure 4].

Single-fracture *vs.* multiple-fracture

Among all facial fracture repair patients, 2,563 (79.6%) had single facial fractures and 657 (20.4 %) had multiple facial fractures. In the single-fracture group, the most common fracture was mandibular. In the multiple-fractures group, there was an average of 2.28 (SD = 0.62) fractures per patient [1,500 fractures in 657 people] and the most common fractures were mandibular and zygomaticomaxillary fractures [Figure 2]. Zygomaticomaxillary fractures were significantly higher in multiple fractures ($P = 0.027$). In both

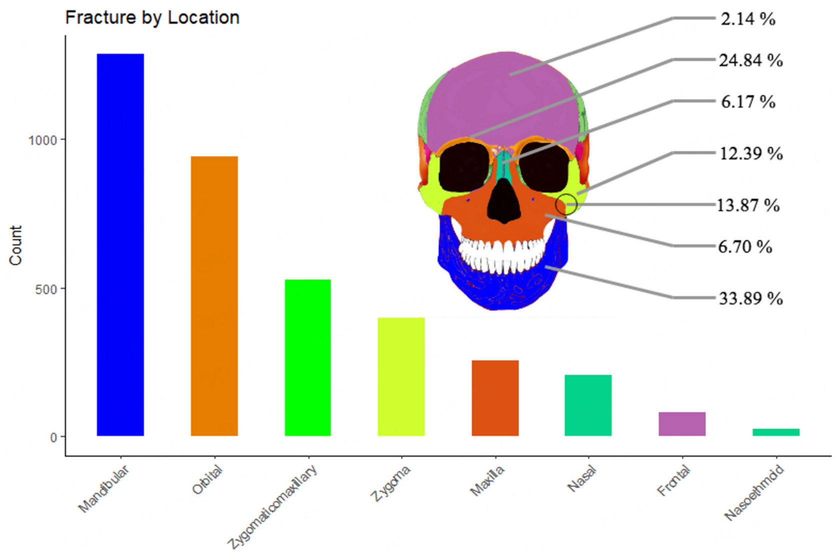

Figure 2. Number of patients by fracture location. The bar graph above shows the number of patients who underwent facial fracture treatment, sorted by fracture location. The skull diagram represents the prevalence percentages of each fracture location.

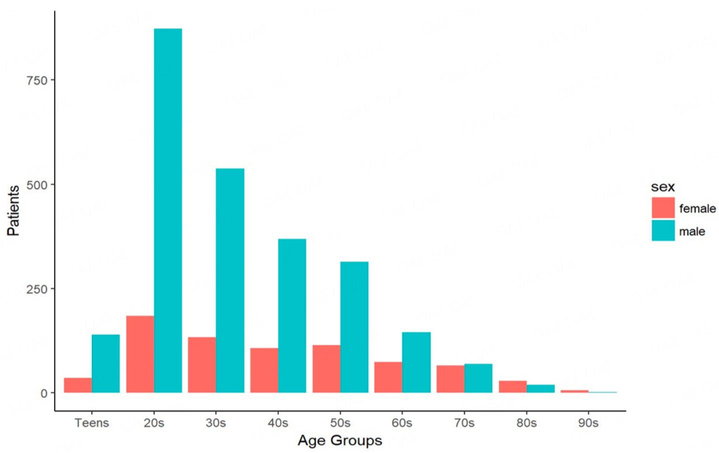

Figure 3. Facial fracture treatment prevalence by age and sex. The bar graph above shows the age distribution of facial fracture patients from 2012 to 2016. The majority of patients undergoing facial fracture treatment are males in their twenties.

fracture groups, trends showed a higher prevalence in male patients than in female patients. The most prevalent age group was in the twenties. There was no statistical difference in age or sex between the two groups [Table 2]. Preoperative factors showed no statistically significant difference based on single-vs-multiple fractures except for hypertension ($P = 0.0437$). There was a statistically significant difference in surgeon specialty between the single and multiple-fracture groups ($P < 0.0001$).

Surgical specialty

Among the 3,354 cases analyzed in this study, 1,418 (44.0%) patients were operated on by plastic surgeons and 1,802 (56.0%) were operated on by non-plastic surgeons. Plastic surgeons treated zygomatic and orbital fractures more frequently than non-plastic surgeons ($P = 0.0004$ and $P = 0.011$, respectively) [Figure 4]. Of single fractures, most were ENT cases, and of the multiple fractures, most were plastic cases [Figure 5]. Patients operated on by plastic surgeons were less likely to be identified as white or Hispanic compared to non-plastic surgeons ($P = 0.0253$ and $P < 0.0001$, respectively). There was an association between fracture

Table 2. Total and single-fracture *vs.* multiple-fracture epidemiological data

	Total patients (%)	Single fracture (%)	Multiple fractures (%)	*P*-value
No.	3220	2563	657	
Sex				0.0667
Male	2469 (76.6)	1947 (75.9)	522 (79.4)	
Female	751 (23.32)	616 (24)	135 (20.5)	
Age				
Mean, yr	39.05	38.7	39.4	0.0846
Teens	176 (5.4)	142 (5.5)	34 (5.1)	
20s	1057 (32.8)	855 (33.3)	202 (30.7)	
30s	671 (20.8)	525 (20.4)	146 (22.2)	
40s	477 (14.8)	387 (15)	90 (13.6)	
50s	428 (13.2)	331 (12.9)	97 (14.7)	
60s	220 (6.8)	166 (6.4)	54 (8.2)	
70s	147 (4.5)	122 (4.7)	25 (3.8)	
80s	48 (1.4)	43 (1.6)	5 (0.7)	
Race				0.133
African American	637 (19.7)	518 (20.2)	119 (18.1)	
Asian	87 (2.7)	74 (2.8)	13 (1.9)	
American Indian or Alaska Native	12 (0.4)	6 (0.2)	6 (0.9)	
Native Hawaiian or Pacific Islander	24 (0.74)	20 (0.7)	4 (0.6)	
White	1,762 (54.7)	1,364 (53.2)	398 (60.5)	
Hispanic	237 (7.3)	183 (7.1)	54 (8.2)	
Quarter of admission				0.718
First	756 (23.4)	612 (23.8)	144 (21.9)	
Second	777 (24.1)	618 (24.1)	159 (24.2)	
Third	901 (27.9)	715 (27.8)	186 (28.3)	
Fourth	786 (24.4)	618 (24.1)	168 (25.5)	
Body mass index				0.216
Underweight	99 (3)	80 (3.1)	19 (2.8)	
Normal	1,320 (40.9)	1,026 (40)	294 (44.7)	
Overweight	1,011 (31.3)	816 (31.8)	195 (29.6)	
Obesity	612 (19)	496 (19.3)	116 (17.6)	
Diabetes mellitus				0.678
Yes	226 (5.42)	199 (5.7)	27 (3.97)	
No	3,941 (94.6)	3,287 (94.3)	654 (96)	
Hypertension				**0.0437**
Yes	484 (15)	371 (14.4)	113 (17.1)	
No	2,736 (84.9)	2,192 (85.5)	544 (82.8)	
Smoking				0.368
Yes	1,369 (42.5)	1,079 (42)	290 (44.1)	
No	1,851 (57.4)	1,484 (57.9)	367 (55.8)	

Table 2 shows demographic data of all 3,220 patients who underwent facial fracture treatment from years 2012 to 2016. *P*-values assess statistical significance between the single-fracture and multiple-fractures groups.

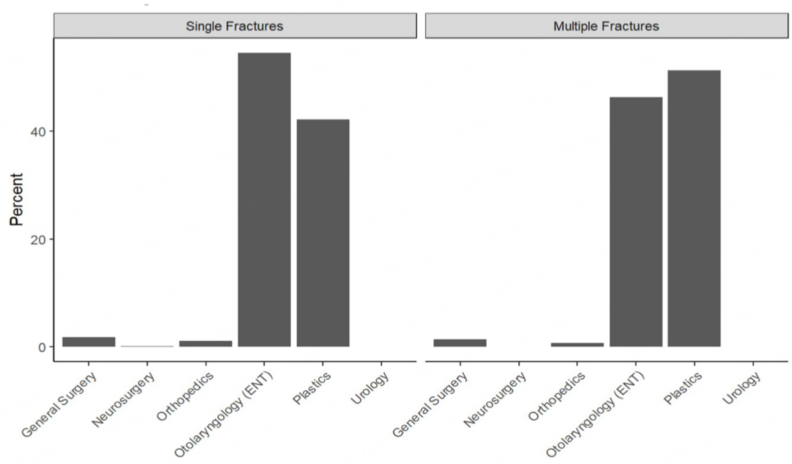

Figure 4. Number of patients by fracture location between surgical specialties. The figure above compares the number of treated patients for each fracture location between surgical specialties. Bolded percentages indicate a higher frequency of facial fracture treatment in a specific location by the surgical specialty group.

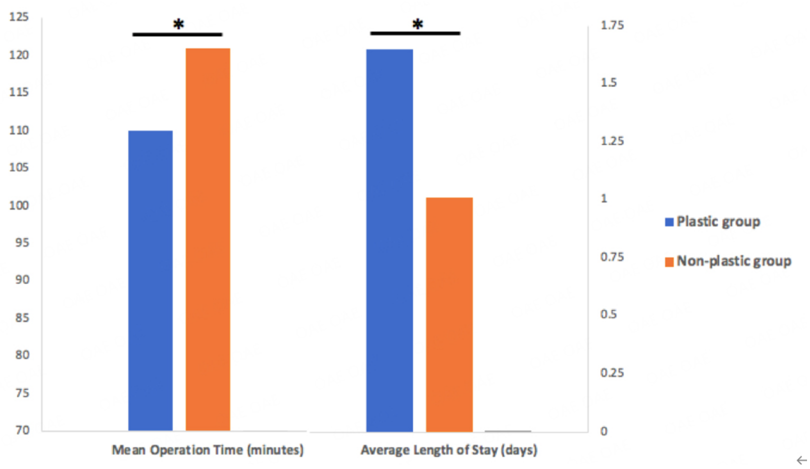

Figure 5. Facial fracture treatment prevalence by fracture location and sex. The bar graph above shows the fracture location distribution of facial fracture patients from 2012 to 2016. Most male patients underwent mandibular fracture treatment, while most female patients underwent orbital fracture treatment.

location and surgical specialty [Figure 6] (P < 0.0001). In regards to preoperative factors, hypertension showed a statistically significant difference based on surgical specialty (P = 0.0109), while smoking, diabetes and Body Mass Index (BMI) showed no statistically significant differences (P = 0.498, P = 0.550 and P = 0.939, respectively). There was a statistically significant difference in patient ASA classification and functional status (P = 0.0352 and P = 0.0445, respectively) based on surgical specialty [Table 3].

Outcomes and postoperative complications

Plastic surgeons' operating time was less than that of non-plastic surgeons (P = 0.0007), with a mean duration of 110 min (plastic) and 121 min (non-plastic). The average length of stay was higher for the plastic group, with a mean of 1.65 days (plastic) and 1.01 days (non-plastic) (P < 0.00001) [Figure 7]. From 2012 to 2016, 3,220 cases were evaluated for postoperative complications within 30 days of operation. Out of the 3,220 facial fracture patients, 256 had complications (7.96%). Surgical complication, medical complication, and reoperation rate were 2.67, 0.84, and 2.70%, respectively. The mortality rate was 0.25%.

Table 3. Plastic *vs.* non-plastic groups epidemiological data

	Plastics (%)	Non-plastics (%)	*P*-value
No.	1,418	1,802	
Sex			0.391
Male	1,098 (77.4)	1,371 (76)	
Female	320 (22.5)	431 (23.9)	
Age			
Mean, yr	39.5 (2.7)	38.3 (2.1)	0.311
Teens	76 (5.3)	100 (5.5)	
20s	436 (30.7)	621 (34.4)	
30s	297 (20.9)	374 (20.7)	
40s	231 (16.2)	246 (13.6)	
50s	184 (12.9)	244 (13.5)	
60s	104 (7.3)	116 (6.4)	
70s	65 (4.5)	70 (3.8)	
80s	22 (1.5)	26 (1.4)	
Race			0.177
African American	227 (16)	410 (22.7)	
Asian	31 (2.1)	56 (3.1)	
American Indian or Alaska Native	5 (0.3)	18 (0.9)	
Native Hawaiian or Pacific Islander	13 (0.9)	11 (0.6)	
White	99 (6.9)	138 (7.6)	**0.0253**
Hispanic	600 (42.3)	1,162 (64.4)	**< 0.00001**
Quarter of admission			0.815
First	336 (23.6)	420 (23.3)	
Second	349 (24.6)	428 (23.7)	
Third	398 (28)	503 (27.9)	
Fourth	335 (23.6)	451 (25)	
Body mass index			0.939
Underweight	44 (3.1)	55 (3)	
Normal	562 (39.6)	758 (42)	
Overweight	430 (30.3)	581 (32.2)	
Obesity	268 (18.8)	344 (19)	
Diabetes mellitus			0.55
Yes	71 (5)	93 (5.1)	
No	1,347 (94.9)	1,709 (94.8)	
Hypertension			**0.0109**
Yes	187 (13.1)	297 (16.4)	
No	1,231 (86.8)	1,505 (83.5)	
Smoking			0.489
Yes	613 (43.2)	756 (41.9)	
No	805 (56.7)	1,046 (58)	
Functional status			**0.0445**
Independent	1,403 (98.9)	1,765 (97.9)	
Partially dependent	3(0.2)	16(0.8)	
Totally dependent	3 (0.2)	4 (0.2)	
ASA classification			**0.0352**
No disturbance	403 (28.4)	440 (24.4)	
Mild disturbance	775(54.6)	1008(55.9)	
Severe disturbance	229 (16.1)	334 (18.5)	

Life threatening	11 (0.7)	20 (1.1)

Table 2 shows demographic data of all 3,220 patients who underwent facial fracture treatment from years 2012 to 2016 by surgical specialty. *P*-values reflect statistical significance between the plastic and non-plastic groups.

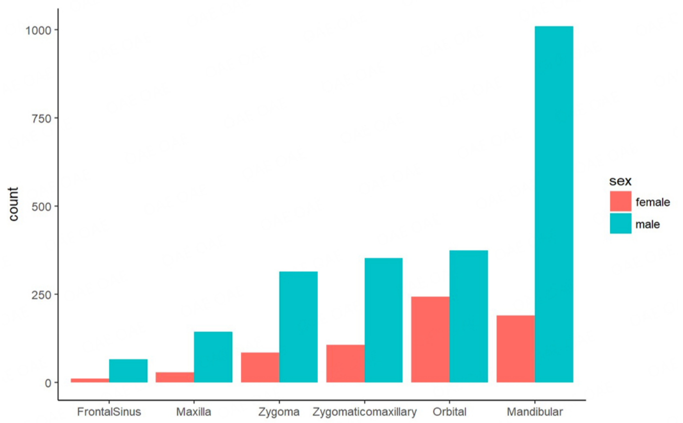

Figure 6. Comparison of outcome. The plastic group had a shorter mean operation time and a longer average length of stay than the non-plastic group ($P = 0.0007$, $P < 0.0001$, respectively).

All postoperative complication variables showed no statistically significant differences between the plastic and non-plastic groups [Table 4].

DISCUSSION

The management of facial fractures is estimated to incur a cost of $1 billion in 2007, along with an additional $5 billion in emergency room charges in 2008[1,19]. Moreover, facial trauma has been associated with psychological, functional and aesthetic effects on patients due to adjustment and adaptation to facial disfigurement and chronic pain[20,21]. The objectives of this study were to confirm previously established trends and to provide new insights into current management conditions, post-surgical complications, and performance by surgical specialty for facial fractures. While new data is generated every year for patients undergoing surgical procedures in the United States, information devaluation, or exponential decay of data lifespan and value over time, occurs[22]. Therefore, analysis of up-to-date data is vital for optimal healthcare operations and allocation of healthcare resources. For these reasons, continuous epidemiologic and outcomes data analysis is important to reduce the incidence, costs, and complications of facial fractures by providing new insights into current management and patient care practices.

Previous facial fracture epidemiologic studies either do not reflect current data, are single-institution investigations, or lack consistent postoperative complications and outcome analysis[5-16]. The ACS-NSQIP database has made significant changes to its collected variables since 2011 and increased the number of cases collected four-fold, warranting an up-to-date investigation of facial fracture treatment trends in the United States, with the opportunity to include surgical specialty into consideration. Using the ACS-NSQIP database eliminates interinstitutional variations, yielding unbiased treatment outcome analysis.

Facial fracture epidemiology

Data analysis showed that male subjects received facial trauma treatment more frequently (76.6%) than female subjects, consistent with previously reported studies[6-16]. Mandibular fractures were the most common in male patients, whereas orbital fractures were most common in female patients [Figure 5].

Table 4. Postoperative complications

	Number of cases total (%)	Number of cases plastic surgeon (%)	Number of cases non-plastic (%)	*P*-value
Surgical complication	86 (2.67)	40 (2.82)	> 46 (2.55)	0.72
Superficial SSI	29 (0.90)	14 (0.99)	> 15 (0.83)	0.78
Deep SSI	18 (0.56)	11 (0.78)	> 7 (0.39)	0.22
Wound Disruption	17 (0.53)	5 (0.35)	12 (0.67)	0.33
Organ/Space SSI	8 (0.25)	3 (0.21)	5 (0.28)	0.99
Reoperation	87 (2.70)	40 (2.82)	> 47 (2.61)	0.80
Medical complication	27 (0.84)	10 (0.71)	17 (0.94)	0.59
Renal complication	9 (0.28)	1 (0.07)	8 (0.44)	0.10
Pulmonary complication	31 (0.96)	10 (0.71)	21 (1.17)	0.10
Mortality	8 (0.25)	4 (0.28)	> 4 (0.22)	1.00
Sepsis/septic shock	6 (0.19)	3 (0.21)	> 3 (0.17)	1.00
Cardiac complication	2 (0.06)	1 (0.07)	> 1 (0.06)	1.00

Out of the 3220 facial fracture patients, 256 had complications (7.96%).

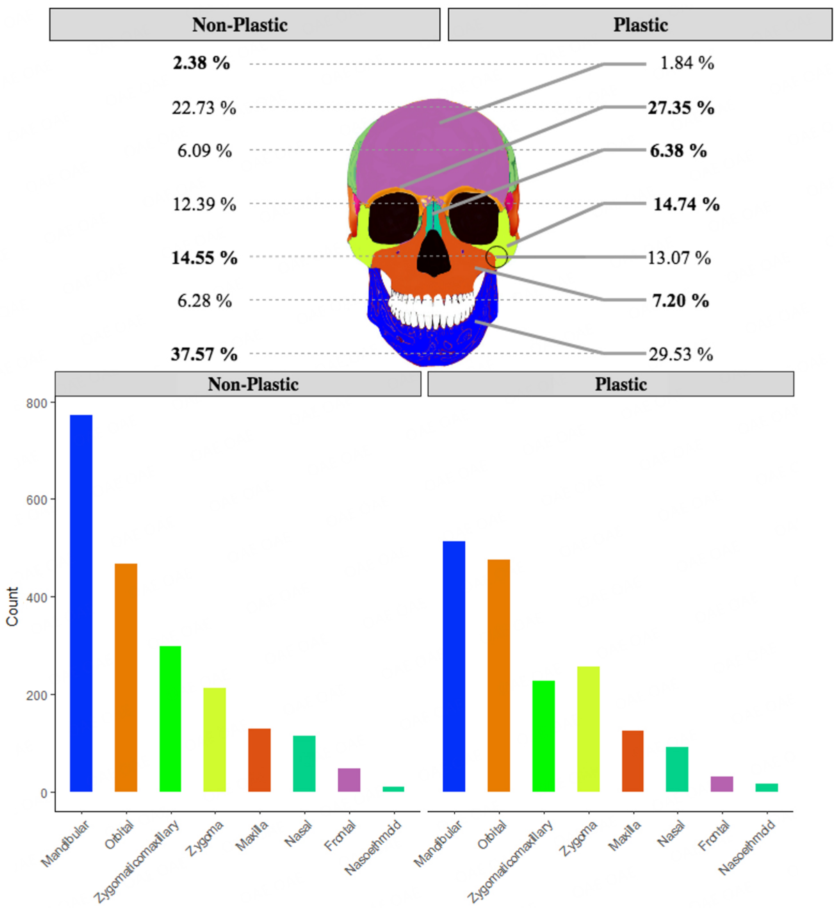

Figure 7. Operating surgical specialty in single *vs.* multiple-fractures groups. The Y-axis represents the percentage of patients undergoing facial fracture treatment for each surgical subspecialty, which is shown on the x-axis. Of single fractures, most operating surgeons are ENT surgeons, and of the multiple, most are plastic surgeons.

Previous studies have found a high prevalence of orbital fractures in women, which may be related to domestic violence[23]. Mean age was 39.05 years, indicating an older population. Patients in their twenties were the most frequently reported for fracture treatment, possibly due to their increased physical ability and engagement in risky environments [Figure 3]. Our prevalence data for fracture treatment based on race, functional status and ASA classification confirm previous trends and validate their reliability.

Single *vs.* multiple fracture groups

There were no statistically significant differences in demographic variables between the single and multiple fracture groups. In regards to preoperative conditions, there were statistically significant differences in hypertension between the single and multiple fracture groups; 17.1% of patients with multiple fractures had preoperative hypertension compared to 14.4% in the single fracture group ($P = 0.0437$). This finding corroborates studies reporting hypertension as a risk factor for decreased bone mineral density (BMD) and bone fractures[24]. There was a statistically significant association between surgical specialty and the single and multiple fracture groups ($P < 0.0001$); of single fractures, most were operated on by ENT (57.67%, 1,473 cases) and more than half of multiple fractures were operated on by plastic surgeons (51.29%, 327 cases) [Figure 7].

Plastic *vs.* non-plastic groups

Epidemiological data showed statistically significant differences in the patient's reported race by surgical specialty; surgeons who operated on patients identified as white or Hispanic were less likely to be in the plastic group. This could be explained by the shortage and asymmetrical distribution of plastic surgeons in the United States (over 25 million people lack geographic access to the specialty)[25]. There were no statistically significant differences in patient age, sex, BMI, diabetes, and smoking between the plastic and non-plastic group. There was an association between preoperative hypertension, functional status and ASA classification between the plastic and non-plastic group ($P = 0.0109$, $P = 0.0445$, and $P = 0.0352$, respectively); this further emphasizes plastic surgeons' set of skills in treating multiple fractures, for which hypertension is a risk factor. ASA classification and functional status findings indicate that plastic surgeons operated more frequently on healthier patients (lower ASA classification number) and less frequently on patients with a dependent-labeled functional status compared to non-plastic surgeons.

Fracture location

Overall, the most common fractures were mandibular then orbital [Figure 2], consistent with previous studies. Traumatic mandibular fractures are common due to the mobility, protuberance and large surface area of the mandible. Interpersonal violence is the leading cause of mandible fractures in men[26,27]. Figure 4 shows fracture treatment location by surgical specialty. Statistical analysis showed that specialty is dependent on the fracture location, with plastic surgeons operating on orbital, nasal, zygomatic and maxillary areas more frequently whereas non-plastic surgeons treating mandibular, zygomaxillary and frontal fractures more frequently ($P < 0.0001$). This finding shows again that fracture location treatment seems to be dependent on each specialty's unique expertise and set of skills.

Postoperative complications and outcomes

Out of the 3,220 facial fracture patients, 256 had complications (7.96%). Surgical complications and unplanned reoperation were the most common (2.67 and 2.70%, respectively). Similar postoperative complication rates have been reported previously[4,28-30]. Our data analysis showed no statistically significant differences in postoperative complications between the plastic and non-plastic groups (55.5% and 44.5%, respectively). Kim *et al.* 2013 found similar results for 1,147 patients from 2005 to 2011 in the US[4].

Our primary outcomes of interest were the average length of stay and mean operation time. A large database is necessary for the length of stay and operation time evaluation since potential variables (such as age and sex) could confound these outcomes[31]. There was an association between operation time and surgical specialty ($P = 0.0007$) as well as between average length of stay between surgical specialty groups ($P < 0.00001$); plastic surgeons' mean operating time was lower and patients' average length of stay was longer than the non-plastic group. Prolonged operation time has been correlated with an increased risk of SSI, as well as with increased use of healthcare resources and higher costs[32,33]. No previous studies have investigated the length of stay in association with postoperative complications of facial fractures or surgical specialty.

Limitations

This study presents important limitations for consideration. Variables in the ACS-NSQIP database are standardized yet incomplete. Outcomes and risk factors that are not continuously collected in the database could be of high significance to the study. These variables include but are not limited to diplopia, malocclusion, hypoesthesia, asymmetry, and malunion. Another important variable is the cause of fracture; this would allow the evaluation of concurrent procedures and co-existing conditions. Moreover, the lack of data captured beyond 30 days postoperatively limits the collection of subacute or delayed complications as well as the overall aesthetic results of treatment. Finally, only patients over the age of 16 were available for assessment in the ACS-NSQIP database. Hence, the data age distribution is truncated and is not representative of the whole patient population. In addition, the sample in this may be considered heterogeneous: it includes patients with different types of facial fractures that cannot be categorized into smaller groups with similar features based on the severity and type of fractures. Further studies may look into these different groups by classifying the fractures by site and severity. Ophthalmologists and Oral & Maxillofacial surgeons are not included in the ACS NSQIP database. As a result, the data analyzed may be an incomplete representation of managed facial trauma injuries in the US. The Comprehensive Face Injury (CFI) score, which assigns a severity mean to each face injury in a reliable, repeatable manner, is one of the significant severity rating methods available in the literature today[34]. Despite the fact that the ACS-NSQIP database offers a sample of exceptional value for its size, it is likely impossible to accurately characterize the severity of the patients who make up the sample.

CONCLUSION

In this study, we provide new insights into the treatment of facial fracture patients. Assessment of complication rates between surgical specialties allows a better understanding of the current management of facial fracture patients on a national level. Our data analysis may allow surgeons to better counsel patients preoperatively and improve inter-specialty collaboration in order to optimize outcomes, patient satisfaction, and cost-efficacy.

DECLARATIONS

Authors' contributions

Contributed via the conception and design of the study, and manuscript writing: Akiki RK
Performed data analysis: Crozier J
Performed data analysis and manuscript editing: Basta M
Made substantial contributions to the conception and design of the study, and performed data analysis and interpretation as well as manuscript review: Woo AS

Availability of data and materials

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Conflicts of interest
All authors declared that there are no conflicts of interest.

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Not applicable.

Consent for publication
Not applicable.

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