Short Report: Profile of Co-morbidities in the Obese.

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Abstract: Objective: To study the profile of co-morbidities in obese patients reporting for bariatric surgical procedures.
Methods: A retrospective study was conducted at the Bariatric Surgery Unit of Department of Surgery of the College of Medicine, Qassim University, Saudi Arabia. The records of all the obese patients (with Body Mass Index greater than 30), evaluated in the department over the period of two years from Jan 2012 to Dec 2014, were studied and co-morbidities were sought in all subjects. Results: Of the 172 subjects, 76.2% (n=131) were female and 23.8% (n=41) male. The age ranged from 17–49 years (Mean 29.9 years; Mode 28 years). The weight ranged from 82 kg–146 kg and BMI ranged from 33–54 (mean BMI 44.7 kg/m²). The co-morbidities found in our study are as shown in Table 1 and Fig 1.

Introduction: Obesity is a serious public health problem and in recent years, it has emerged as a global epidemic.(1) The disease is widely prevalent in developed countries and is increasing at alarming pace in developing ones.(2-5) In the US, the prevalence of overweight and obesity now exceeds 60% among adults, and the rate is rapidly increasing among children and adolescents.(5) In Saudi Arabia, the prevalence of overweight is 19.5% in males and 20.8% in females while that of obesity is 24.1% in males and 14% in females.(6) Obesity is associated with a wide range of co-morbidities that tend to decrease the life span by as much as 5 years.(5,7,8) It was with this background, a study was undertaken to study the profile of co-morbid conditions in the obese patients attending the Obesity Surgical Unit.

Materials and Methods
A retrospective study was conducted at the Bariatric Surgery Division of the Department of Surgery of the College of Medicine, Qassim University, Saudi Arabia. The records of all the obese patients (with Body Mass Index greater than 30), evaluated in the department over the period of two years from January 2012 to December 2014, were studied and co-morbidities were sought in all subjects. History, physical examination, blood investigations, electrocardiogram, upper gastrointestinal endoscopy and imaging studies were scrutinised and findings recorded in a self designed table. The comorbidity was considered to exist when evidences in the form of documented final diagnosis from Consultant of the concerned specialty was found in the records, to avoid faulty inclusion of condition based on provisional diagnosis. The exclusion criteria included the patients with BMI below 30 and the ones with incomplete medical records. Data obtained in this way converted in variables, which were analyzed using computer based statistical programme SPSS version 12 and Microsoft Excel 2010.

Results
A total of 172 patients were included in the study including 131 females (76.2%) and 41(23.8%) males. The age ranged from 17–49 years (Mean 29.9 years; Mode 28 years). The weight ranged from 82 kg–146 kg and BMI ranged from 33–54 (mean BMI 44.7 kg/m²). The co-morbidities found in our study are as shown in Table 1 and Fig 1.
Obesity has been established as a risk factor for development of many co-morbidities. The pathogenesis of these co-morbidities is multifactorial and includes specific pathogenic factors, including supersaturated bile and crystal formation, rapid weight loss, and visceral obesity. Obesity has increased in a phenomenal fashion over the last few decades globally and poses a serious threat to the quality of health and life span of humans. In recent years, it has been proven that obesity is associated with multiple major co-morbidities (7-8) that can lead to further morbidity, mortality and substantial increase in healthcare costs. In Saudi Arabia also, obesity is increasingly becoming a major health issue and the prevalence of overweight is 19.5% in males and 20.8% in females while that of obesity is 24.1% in males and 14% in females. It was against this background that the present study was undertaken.

The most commonly affected system in our series was gastrointestinal system and the prominent co-morbidities. Gastrointestinal co-morbidities are widely reported by other workers. Of our patients 52 (30.2%) had evidences of non-alcoholic fatty liver disease (NAFLD) based on ultrasound imaging and negative histological examination of hepatic tissue in the absence of significant alcohol consumption. Of these 52 cases, 21 (40.3%) had evidences of steatosis to nonalcoholic steatohepatitis with or without cirrhosis development. Our results correlate with the figures mentioned in the literature. In a series by Gupta R et al (12), non-alcoholic fatty liver was detected in 15.4% of obese children whereas El-Koofy NM (13) found this disease in 44% of obese children of Saudi origin. Gallstones were documented in 27 (16%) patients and this figure corroborates with the figures mentioned in literature. Obesity has been established as a risk factor for development of cholesterol gallstones and exposes patients to increased risk of gallstone-related complications.

Besides, the chance to develop acute pancreatitis and the severity of the disease are higher in obese patients due to the specific pathogenic factors, including supersaturated bile and crystal formation, rapid weight loss, and visceral obesity. The risk is especially high in those with the higher body mass index (BMI) and the relative risk is about 5-6. Weight loss further increases the risk of gallstones formation: the incidence of new gallstones reaches 10-12% after 8-16 weeks of low-calorie diet and more than 30% within 12-18 months after bariatric surgical operations.

In the present study we included 172 obese children. 96 (56%) including 72 females and 24 males had one or more co-morbidities mentioned in Table 1 and 76 (44%) including 59 females and 17 males, did not have any detectable co-morbidity as per the available records. This result is depicted in Fig 2. A total of 435 co-morbid conditions were identified from the records having two, 7 having three and 87 cases having more than three co-morbidities.

### Discussion

### Table 1: Details of the co-morbid condition in the obese.

<table>
<thead>
<tr>
<th>System</th>
<th>Co-morbidity</th>
<th>Number (n)</th>
<th>Percentage (%)</th>
</tr>
</thead>
<tbody>
<tr>
<td>Gastrointestinal</td>
<td>Non-alcoholic fatty liver disease</td>
<td>52</td>
<td>30.2%</td>
</tr>
<tr>
<td></td>
<td>(NAFLD)</td>
<td></td>
<td></td>
</tr>
<tr>
<td></td>
<td>Gallstones (On USG or post cholecystectomy)</td>
<td>27</td>
<td>15.7%</td>
</tr>
<tr>
<td></td>
<td>Gastro-oesophageal Reflux</td>
<td>15</td>
<td>8.7%</td>
</tr>
<tr>
<td></td>
<td>Hiatus hernia</td>
<td>3</td>
<td>1.7%</td>
</tr>
<tr>
<td></td>
<td>H. Pylori gastritis</td>
<td>31</td>
<td>18%</td>
</tr>
<tr>
<td></td>
<td>Crohn’s Disease</td>
<td>1</td>
<td>0.6%</td>
</tr>
<tr>
<td></td>
<td>Bile reflux gastritis</td>
<td>3</td>
<td>1.7%</td>
</tr>
<tr>
<td>Endocrinological</td>
<td>Type 2 Diabetes</td>
<td>14</td>
<td>8.1%</td>
</tr>
<tr>
<td></td>
<td>Hypothyroidism</td>
<td>16</td>
<td>9.3%</td>
</tr>
<tr>
<td>Cardiovascular</td>
<td>Hypertension</td>
<td>11</td>
<td>6.4%</td>
</tr>
<tr>
<td></td>
<td>Ischemic heart disease</td>
<td>1</td>
<td>0.6%</td>
</tr>
<tr>
<td></td>
<td>Varicose veins</td>
<td>7</td>
<td>4.1%</td>
</tr>
<tr>
<td>Metabolic</td>
<td>Dyslipidemia</td>
<td>27</td>
<td>15.7%</td>
</tr>
<tr>
<td></td>
<td>Vitamin D Deficiency</td>
<td>46</td>
<td>26.7%</td>
</tr>
<tr>
<td></td>
<td>Altered Liver function</td>
<td>21</td>
<td>12.2%</td>
</tr>
<tr>
<td>Skeletal</td>
<td>Osteoarthritis (knees +/- hips)</td>
<td>7</td>
<td>4.1%</td>
</tr>
<tr>
<td></td>
<td>Vertebral disc prolapsed</td>
<td>2</td>
<td>1.2%</td>
</tr>
<tr>
<td></td>
<td>Chronic back ache</td>
<td>11</td>
<td>6.4%</td>
</tr>
<tr>
<td>Skin</td>
<td>Striae distensae</td>
<td>66</td>
<td>3.8%</td>
</tr>
<tr>
<td></td>
<td>Intertrigo</td>
<td>26</td>
<td>15.1%</td>
</tr>
<tr>
<td></td>
<td>Plantar hyperkeratosis</td>
<td>3</td>
<td>1.7%</td>
</tr>
<tr>
<td></td>
<td>Omphalolith</td>
<td>1</td>
<td>0.6%</td>
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<tr>
<td>Psychiatric</td>
<td>Depression/Axiety</td>
<td>13</td>
<td>7.6%</td>
</tr>
<tr>
<td>Respiratory</td>
<td>Bronchial asthma</td>
<td>9</td>
<td>5.2%</td>
</tr>
<tr>
<td></td>
<td>Sleep apnoea</td>
<td>2</td>
<td>1.2%</td>
</tr>
<tr>
<td>Reproductive</td>
<td>Abnormal menses</td>
<td>16</td>
<td>9.3%</td>
</tr>
<tr>
<td></td>
<td>Infertility</td>
<td>4</td>
<td>2.3%</td>
</tr>
</tbody>
</table>

Fig 2: Proportion of obese with Vs without co-morbidity condition.

Out of the total of 172 patients, 96 (56%) including 72 females and 24 males had one or more co-morbidities mentioned in Table 1 and 76 (44%) including 59 females and 17 males, did not have any detectable co-morbidity as per the available records. This result is depicted in Fig 2. A total of 435 co-morbid conditions were identified from the records having two, 7 having three and 87 cases having more than three co-morbidities.

### Discussion

Obesity has increased in a phenomenal fashion over the last few decades globally and poses a serious threat to the quality of health and life span of humans. In recent years, it has been proven that obesity is associated with multiple major co-morbidities (7-8) that can lead to further morbidity, mortality and substantial increase in healthcare costs. In Saudi Arabia also, obesity is increasingly becoming a major health issue and the prevalence of overweight is 19.5% in males and 20.8% in females while that of obesity is 24.1% in males and 14% in females. It was against this background that the present study was undertaken.

The most commonly affected system in our series was gastrointestinal system and the prominent co-morbidities. Gastrointestinal co-morbidities are widely reported by other workers. Of our patients 52 (30.2%) had evidences of non-alcoholic fatty liver disease (NAFLD) based on ultrasound imaging and negative histological examination of hepatic tissue in the absence of significant alcohol consumption. Of these 52 cases, 21 (40.3%) had evidences of steatosis to nonalcoholic steatohepatitis with or without cirrhosis development.

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Banim PJ et al (18) in 2011 published the results of the study...
undertaken to precisely quantify the risks of gallstones formation due to obesity and to investigate whether the aetiological mechanism may involve serum lipids. The study concluded that obesity exerts influence on gallstone formation, possibly in part through their effects on serum lipids and that by reducing obesity may prevent gallstones formation, as 38% of incident cases of gallstones were associated with a BMI of more than 25.

Gastritis due to Helicobacter pylori was documented after upper gastrointestinal endoscopy and biopsy in 31 (18%). There are many studies in literature that show that the prevalence of H. pylori is increased in subjects with obesity and many workers have postulated that obesity can be a risk factor for H. pylori infection but the precise relationship between the two is still debatable. Some other workers have postulated that the infection may actually be protective against obesity because of the gastropathy-induced decrease in production and secretion of ghrelin (the orexigenic hormone).(19) The clinical management of H. pylori infection is complicated in obese patients, by the lower eradication rates with standard therapeutic regimens reported than in the normal-weight population (19) and the current guidelines do not indicate clearly the management of H. pylori infection in obese patients planning to undergo bariatric surgery, and the need or otherwise, for H. pylori screening and eradication before surgery is still debated.(19) Takahashi Y et al (20) in recent study from Japan have postulated H. pylori infection to be positively associated with gallstones and as mentioned above, gallstones do have high prevalence in the obese. A study from Germany (21) showed the prevalence of H. pylori to be 55% in morbidly obese whereas in a study from Saudi Arabia, Ahmad M Al-Akwa (22) found the prevalence of H. pylori infection with chronic active gastritis in 53 out of 62 (85.5%) morbidly obese patients referred for endoscopy prior to bariatric surgery.

Gastro-oesophageal reflux disease (GERD) was seen in our series in 15 (8.7%) cases. GERD is frequently mentioned in literature in association with the obese population and the acid reflux has been found to be related to the BMI (23) in asymptomatic as well as symptomatic erosive disease.(24) Peralta-Torres NM et al (25), however did not find any association between symptoms of GERD and obesity. The endocrinological disorders revealed in our series include Type 2 diabetes mellitus (T2DM) in 14 (8.1%) cases and hypothyroidism in 16 (9.3%) cases. T2DM is mentioned as an important disorder of obesity in literature. The link between obesity and T2DM is supported in literature by evidence from both cross-sectional (26) and prospective cohort studies (27) and the reports have consistently upheld a strong positive association between T2DM and BMI.(26,28) Similarly, the overall thyroid dysfunction has been found more in obese individuals than the normal controls, with varying degree of significance.(29) The thyroid dysfunction has been found to normalize in most of the subjects after weight loss due to bariatric surgical interventions.(30,31)

Dyslipidemia (n=27; 15.7%), Vitamin D deficiency (n=46; 26.7%) and alteration of liver function (n=21, 12.2%) were noted in our series. Dyslipidemia is a metabolic derangement characterized by elevation of total cholesterol and triglyceride levels, normal to elevated low density lipoprotein (LDL) cholesterol, reduced levels of high density lipoprotein (HDL) cholesterol, and elevated low-density apolipoprotein B and there are numerous studies, that have proven that obesity is associated with adverse lipid profiles, and conversely weight loss is associated with improvements in lipid profiles.(32,33) Vitamin D deficiency has been linked independently to obesity in many studies, by the lower eradication of the vitamin D deficiency is high is Saudi Arabia, irrespective of adequate (36) or inadequate exposure to sun (37), leading to recommendations for higher level of fortification of food products with vitamin D.(37)

Obesity has been proven to be a well-defined and consistent hazard for cardiovascular disease as obesity is strongly linked to well establish cardiovascular risk factors including diabetes, hypertension, and dyslipidemia.(38-40) The number of patients with cardiovascular disorders in our series is lesser as compared to literature.(41) Hypertension was seen in 11 (6.3%) and venous varicosities in 7 (4.1%). This may be explained by the fact that we studied a selective cohort of obese patients referred for bariatric surgical intervention and during the initial two years of the services, preferences were given to younger stable patients and more morbid ones, were referred to higher established centres.

It is postulated in literature that adipocyte is not merely an inert organ for storage of energy but that it is active in secretion of a wide range of factors that interact with each other, resulting in hypertension.(42) One of such factors of great importance is leptin which is believed to result in hypertension via an activation of the sympathetic nervous system and a direct effect on the kidneys, resulting in increased sodium re-absorption. Furthermore, obesity per se may induce structural changes in the kidneys that may perpetuate hypertension, leading to an increased risk of end-stage renal disease that results in vicious cycle of further hypertension.(42) Stringent control of obesity may eliminate 28-48% of hypertension, thereby having a huge positive impact on quality of life.(41) Obesity is strongly related to wide variety of cutaneous alterations and these disorders may be considered as markers of excessive weight. Many of these disorders are preventable and treatable and hence providing an ample scope of improving patient's quality of life.(43-45) Striae distensae are a disfiguring condition, characterized by linear smooth bands of atrophic appearing skin occurring in areas of dermal damage produced by stretching.(44) This was seen in 66 (38.4%) patients in our series and this figure corroborates with the figures mentioned in literature.(46-49) Intervertebral disc prolapse was documented in 26 (15.1%) cases in our study. This condition results from friction and increased moisture in the deep skin creases leading to maceration and inflammation.(47-48) Decreased mobility and inability to maintain adequate levels of hygiene in deep skin creases may exacerbate this problem. Orthopaedic co-morbidities in form chronic back ache, osteoarthritis of knees and intervertebral disc prolapse was documented in 20 (11.6%) cases. Patients with severe obesity have musculoskeletal pain and disorders that limit their physical function and quality of life.(50,51) The MSK complaints decreased significantly at most sites following weight loss due to bariatric surgical interventions and physical activity. The immense benefits seen with weight loss indicate that prevention and treatment of obesity in the communities can improve MSK health and function.(50)

Depression /anxiety was documented in 13 (7.5%) of our cases. The relationship between obesity and depression has been the focus of many studies however; results from these studies are not consistent.(52) Noh JW et al (52) postulated obesity to be directly linked to depression but Goodman et al (53) suggested that all the obese may not be at risk of getting depressed but only a particular racial/ethnic group may be vulnerable to the psychological effects of obesity in late adolescence and/or early adulthood. Irregularity of menses and infertility was documented in 20 (11.6%) in our series. The broad, negative impact of obesity upon reproductive system is well documented in literature (54-55) and control of obesity can radically change the quality of life in reversing the disorder in great proportion of cases. The negative impact of obesity on reproduction and infertility is manifested both in men and women and both the genders are expected to improve with weight loss.(55)
Similarly, 9 (5.2%) patients suffered from bronchial asthma in our study. Bronchial asthma is, per se, highly prevalent in Saudi Arabia (56) and obesity can complicate the issue and make the control of the disease very difficult. (57,58) Weight loss interventions have shown great potential of improving bronchial asthma. (59)

In recent literature, obesity has been linked with an increased risk of some cancers, including cancers of the oesophagus, colon, kidney, pancreas, and gallbladder, and in females, the cancer of the breast and reproductive system. (60,61) In countries where obesity prevalence has increased rapidly, such as the USA, about 3% of all new cancers are being attributable to obesity. (62) We did not record any such case in our series, as our cohort of cases come through a referral system where such serious diseases get screened out before reaching bariatric surgical services.

**Conclusion:**

Obesity is a disorder which has a wide range of associated co-morbidities and the consequences are substantial. In our series, out of the total of 172 patients that were seen in a bariatric surgical unit, 96 (56 %) including 72 females and 24 males had one or more co-morbidities. The care of the obese needs to be multidisciplinary. Health policies need to be chalked out and implemented to reduce the incidence of obesity worldwide thereby decreasing the incidence of associated co-morbidities and ultimately improve the health status and life span.

**References**