The feasibility of adrenal-sparing surgery in bilateral adrenal neuroblastoma.

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PURPOSE: Loss of adrenal function is a major concern in the treatment of children with bilateral adrenal neuroblastoma (BAN). We aimed to evaluate the feasibility of adrenal-sparing surgery in this unique subgroup.

METHOD: Retrospective review of our center's neuroblastoma database was conducted. Patients with synchronous BAN confirmed at surgery were included. Their demographic data and clinical charts were analyzed.

RESULTS: Five patients were confirmed with BAN. Mean age at diagnosis was 0.89 (0.39-1.32) years; male:female ratio was 4:1. They were stratified as stages M (n = 2), MS (n = 1), L1 (n = 1) and L2 (n = 1). MYCN amplification was present in 1 patient (stage M) and was stratified as high-risk group. All patients except one received preoperative chemotherapy. Among the 10 adrenal gland tumors, 2 underwent tumor adrenalectomy (TA) and 8 had adrenal-sparing tumorectomy (AST). After chemotherapy, 3 patients underwent single-stage bilateral AST and 1 patient underwent 2-stage TA-AST. One patient underwent upfront single-stage TA-AST, where lack of preoperative chemotherapy rendered the adrenal gland indistinguishable. The high-risk patient received autologous hematopoietic cell transplantation for consolidation. No patients required adrenal replacement therapy. All patients were alive without evidence of disease with mean follow-up 5.5 (2.6-8.5) years.

CONCLUSION: Adrenal-sparing surgery is feasible in patients with BAN.
LEVEL OF EVIDENCE: Level IV (case series with no comparison group).
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Refractory shock during the anesthetic and surgical management of an intrahepatic tumor arising from the adrenal cortex: A case report.

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INTRODUCTION: Adrenocortical carcinoma is a rare type of malignant adrenal tumor with a possibility of delayed metastases. Diagnosis may be delayed with a non-secreting tumor or metastasis, and even in this case, surgical management may be complicate.

PRESENTATION OF CASE: A 55-year-old man underwent elective surgery for the resection of a large intra-hepatic mass from an undetermined type according to a recent liver biopsy. He had a previous history of a non-secreting adrenal tumor that was operated ten years before. Pre-operatively, he was poorly symptomatic, with a normal arterial blood pressure. Anesthesia induction was uneventful, but at the time of tumor resection and removal, he developed extreme vasoplegia and shock with anuric renal failure, lactic acidosis, four-limb and abdominal compartment syndrome. The patient died on day 9 from delayed septic complications. According to the pathological findings, the tumor was a non-secreting adrenocortical carcinoma.

DISCUSSION: Adrenocortical carcinoma (ACC) is rare condition with diverse clinical manifestations due to excessive hormonal production when the tumor is secreting and mimicking pheochromocytoma. Our patient underwent the resection a large intrahepatic non-secreting metastasis more than ten years after the initial lesion. Peri-operative and post-operative management was complicated by a refractory shock with the characteristics of a secondary systemic capillary leak syndrome. The role of endothelial lesions may be discussed.

CONCLUSION: Surgery of metastatic adrenocortical carcinoma may be complicated by severe hemodynamic complications, even in the absence of hormonal secretion.

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BACKGROUND: The wide-awake local anesthesia no tourniquet (WALANT) technique in hand surgery is gaining popularity. The authors aimed to prospectively analyze the frequency and type of arrhythmias in patients undergoing hand surgery under local anesthesia and to examine whether the addition of adrenaline affects their incidence.

METHODS: Adult patients undergoing hand surgery under local anesthesia were randomized into two groups: group 1, local anesthesia with lidocaine and tourniquet; and group 2, local anesthesia with lidocaine and adrenaline (WALANT). Patients with a history of arrhythmias were excluded. Patients were connected to Holter electrocardiographic monitoring before surgery and up until discharge. The records were blindly compared between the groups regarding types of arrhythmias, and frequency and timing relative to injection and tourniquet inflation.

RESULTS: One hundred two patients were included between August of 2018 and August of 2019 (age, 59.7 ± 13.6 years; 71 percent women; 51 in each group). No major arrhythmia (ventricular tachycardia, ventricular fibrillation, atrial fibrillation) or arrhythmia-related symptoms were recorded for either group.
Minor arrhythmias (including atrial premature beats, ventricular premature beats, and atrial tachycardia) were recorded in 68 patients (66.6 percent), with no statistical difference between the groups. There were three patients with minor arrhythmias during inflation of the tourniquet. Patients in the adrenaline group had 2 percent sinus tachycardia during injection and 4 percent asymptomatic bradyarrhythmias. These findings do not require any further treatment.

CONCLUSIONS: The authors' results show that hand operations using WALANT technique in patients with no history of arrhythmia are safe and are not arrhythmogenic; therefore, there is no need for routine perioperative continuous electrocardiographic monitoring.

CLINICAL QUESTION/LEVEL OF EVIDENCE: Therapeutic, II.

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The learning curve for the second generation of laparoscopic surgeons: lesson learned from a large series of laparoscopic adrenalectomies.

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BACKGROUND: Laparoscopic adrenalectomy has a well-demonstrated learning curve in the first generation of laparoscopic surgeons. Data about the second generation of laparoscopic surgeons are lacking.

METHODS: In this retrospective observational study, data from patients undergoing laparoscopic adrenalectomy from 2000 to 2019 in a high-volume center were collected and analyzed. The cumulative sum of procedures of each surgeon and the operating time were evaluated. A multivariate analysis with backward stepwise logistic regression was carried out to define which factors influenced the operative time. Three surgeons performed the analyzed procedures: a senior surgeon who began his laparoscopic activity without receiving specific training or supervision and two young surgeons, who performed their procedures under the guidance of the "senior" experienced surgeon. The first 38 procedures of the three surgeons were then compared.

RESULTS: A total of 244 laparoscopic adrenalectomies were performed. Age,
clinical diagnosis, side of the lesion, body mass index, comorbidities, Charlson index, American Society of Anaesthesiologists (ASA) score, and lower abdominal surgery were found to have no significant relationship with the operative time (p > 0.05). Gender, symptoms, previous upper abdominal surgery, size of the lesion, and cumulative sum of procedures were independent predictors of operative time. In the comparison between different surgeons, operative time resulted significantly longer for the senior (165 min; 140-180) than for the two junior surgeons (137.5 min; 115-160; p = 0.003 and 130 min; 120-170; p = 0.001).

CONCLUSIONS: The presence of a mentor in operative theater and specific training programs could be useful during the learning period. The cumulative sum of procedures related to the operative time represents a good parameter to measure the acquired expertise of a surgeon.

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Precise Mapping of Intra-Adrenal Aldosterone Activities Provides a Novel Surgical Strategy for Primary Aldosteronism.
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Segmental selective adrenal venous sampling (sAVS) elucidates an intraadrenal aldosterone activity map (IAMap), which allows us to design a novel surgical treatment strategy for patients with primary aldosteronism. We evaluated the usefulness of sAVS by analyzing 278 patients with whom we had prospectively used IAMap using the criteria of sAVS for surgical indication between 2009 and 2015. We evaluated its diagnostic accuracy using pathological and postsurgical biochemical and clinical outcomes. One hundred twenty and 158 patients were diagnosed with unilateral and bilateral disease, respectively, through sAVS. The concordance of lateralization diagnosis with computed tomography imaging was 66.6%. Among the unilateral patients, we performed partial adrenalectomy in 68 patients whose IAMap showed focal aldosterone hypersecretion from computed tomography-detectable tumor in the affected adrenal gland. All of them achieved complete biochemical success 1 year after surgery. Furthermore, 25 of 158 bilateral disease patients underwent surgical resection because they were preoperatively diagnosed as bilateral aldosterone-producing adenomas by IAMap. These cases showed complete or partial biochemical success (28.0% and 72.0%, respectively); 36.0% showed complete clinical success. Pathological studies demonstrated that all 145 resected specimens possessed aldosterone-producing adenoma or multiple nodules (132 and 13 cases, respectively), and none showed diffuse hyperplasia. IAMap accurately diagnosed both bilateral and unilateral aldosterone-producing adenomas and diffuse hyperplasia before surgery. sAVS
allows a novel surgical strategy for selected PA patients with favorable outcomes.

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Adrenal metastases - long-term results of surgical treatment, single-centre experience.

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INTRODUCTION: The adrenal gland is a frequent site of metastases in different types of cancer. The aim of this study was to assess the results of metastatic adrenalectomy in a single institution and to identify factors for survival.

MATERIAL AND METHODS: A retrospective, single-centre analysis of outcomes of 39 patients (22 male, 17 female) with adrenal metastases who underwent surgery within 14 years (2004-2017) was performed. The median age at the time of adrenal surgery was 64.8 years (range 49-79 years).

RESULTS: In our study group non-small cell lung cancer (NSCLC) was the most frequent primary tumour type (15 pts), followed by renal cell carcinoma (RCC) (14 pts) and colon cancer (6 pts). Most of the metastases - 36 (92%) - were metachronous (> 6 months). All synchronous metastases were NSCLC. The mean time from primary cancer to adrenalectomy was 42.3 months (range 1-176) and was statistically longer for RCC. In 3 patients (8%) metastases were bilateral and both adrenal glands were removed. In all patients, surgery was limited to the adrenal gland, and no major complications of surgery were observed. The median overall survival after metastasectomy was 18 months (3-81) and was statistically longer for colon cancer - 29.5 months (p = 0.012). In patients who died, tumours were significantly bigger than in survivors, 76.5 mm vs. 52.5 mm (p = 0.026).

CONCLUSIONS: Surgery for adrenal metastasis is safe and indications for this procedure should be individualized. In selected patients, surgical removal of adrenal metastasis was associated with longer survival.

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Second day morning cortisol levels after transsphenoidal surgery are accurate
predictors of secondary adrenal insufficiency with diagnostic cut-offs similar to non-stressed conditions.


BACKGROUND: Multiple studies tried to identify cortisol cut-offs after pituitary surgery able to assess accurately hypothalamic-pituitary-adrenal axis function, however there is no consensus nowadays. This study aimed to evaluate the accuracy of morning cortisol after transsphenoidal surgery in predicting long term secondary adrenal insufficiency.

METHODS: In our tertiary Center, we prospectively determined first and second day cortisol after transsphenoidal surgery in 92 patients without preoperative adrenal insufficiency and not treated with glucocorticoids perioperative. Definitive diagnosis of secondary adrenal insufficiency was obtained with re-evaluation three months after transsphenoidal surgery and clinical follow-up of at least one year.

RESULTS: 10 patients (10.8%) developed long-term postoperative secondary adrenal insufficiency. The ROC curves demonstrated that first day cortisol had a moderate diagnostic accuracy, while a second day cortisol ≤9.3 µg/dL (257 nmol/L) showed the best performance in predicting adrenal insufficiency (Se 88.9%, Sp 86.9%, AUC 0.921). Moreover, a second day cortisol ≤3.2 µg/dL (89 nmol/L) was able to diagnose adrenal insufficiency in 100% of cases (Se 22.2%, Sp 100%) and >14 µg/dL (386 nmol/L) was able to exclude ACTH deficiency (Se 100%, Sp 57.4%).

CONCLUSIONS: Adrenal function can be carefully studied in the second day after pituitary surgery, using cut-off values that international guidelines suggested for non-stressed conditions. In fact, second day cortisol levels ≤3.2 µg/dL (89 nmol/L) and >14 µg/dL (386 nmol/L) are diagnostic of secondary adrenal insufficiency and normal function, respectively. We also suggest performing a definitive re-evaluation with an HPA-axis stimulation test when second day cortisol values are between 3.3 and 14 µg/dL (90-386 nmol/L).

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Early Feminizing Genitoplasty in Girls with Congenital Adrenal Hyperplasia (CAH)-Analysis of Unified Surgical Management.

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AIM: To analyze a single-centre experience in feminizing genitoplasty in virilized girls with congenital adrenal hyperplasia (CAH).

METHODS: Review of medical records of all 46, XX CAH patients undergoing single stage feminizing genitoplasty between 2003 and 2018 was performed.
RESULTS: A total of 31 girls aged from 4 months to 10 years were included in the study. The majority (n = 26/31, 84%) were operated before 2 years of age (median 8 months). External virilization was rated as Prader 3 (n = 7/31), Prader 4 (n = 21/31) and Prader 5 (n = 3/31). The urethrovaginal confluence location was low in 19 and high in 12 girls with a percentage distribution similar in Prader 4 and 5 (p > 0.05) but significantly different in Prader 3 (p = 0.017). The follow-up ranged from 12 months to 15 years. All parents assessed the cosmetic result as satisfactory. Perioperative complications occurred in two patients and included rectal injury (n = 1/31) and prolonged bleeding (n = 1/31). Three patients developed late complications including labial atheromas (n = 2/31) and vaginal stricture requiring surgical dilatation (n = 1/31). Low confluence did not decrease the risk of complications.

CONCLUSIONS: Early feminizing genitoplasty in girls with congenital adrenal hyperplasia, irrespective of virilization severity, gives satisfactory cosmetic results and is characterized by low and acceptable surgical risk. Nevertheless, the most important determinant of the effectiveness of such management would be future patients' satisfaction.

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The Peacock study: feasibility of the dynamic characterisation of the paediatric hypothalamic-pituitary-adrenal function during and after cardiac surgery.
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BACKGROUND: Cortisol is the main stress hormone mobilised during surgery to establish homeostasis. Our current understanding of the hypothalamic-pituitary-adrenal axis physiology in children undergoing cardiopulmonary bypass is very limited due to: (1) very few cortisol time point measurements over long periods (2) difficulties of sampling in low weight babies and (3) the concomitant use of glucocorticoids at anaesthesia induction. This lack of understanding is reflected in a lack of consensus on the utility of glucocorticoids perioperatively in cardiac surgery with the use of cardiopulmonary bypass.

METHODS: The Peacock Study is a prospective, two-centre, observational cohort study of 78 children (undergoing cardiopulmonary bypass procedures and non-surgical procedures - split by age/cyanosis) that aims to characterise in detail the hypothalamic-pituitary-adrenal axis physiology of children using the stress model of paediatric cardiac surgery. Also, we aim to correlate cortisol profiles with clinical outcome data. We herein describe the main study design and report the full cortisol profile of one child undergoing heart surgery, thus proving the feasibility of the method.

RESULTS: We used an automated, 24-h tissue microdialysis system to measure cortisol and cortisone, every 20 min. We herein report one cortisol profile of a child undergoing heart surgery. Besides, we measured serum cortisol and adrenocorticotropic hormone at seven-time points for correlation. Tissue concentrations of cortisol increased markedly several hours after the end of surgery. We also noted an increase in the tissue cortisol/cortisone ratio during this response.

CONCLUSION: We report for the first time, the use of an automated microdialysis sampling system to evaluate the paediatric adrenal response in children. Changes in cortisol and cortisone could be measured, and the concentration of cortisol in the tissues increased after the end of cardiac surgery. The method has wide application to measure other hormones dynamically and frequently without the limitation of the circulating blood volume. The data from the main study will clarify how these cortisol profiles vary with age, pathology, type of procedure and correlation to clinical outcomes.

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Adrenal insufficiency represents a debilitating condition which mandates lifelong steroid replacement and which is associated with significant long-term morbidity, due to either inadequate or excessive replacement. The concept of preserving healthy cortical tissue by means of partial adrenalectomy has evolved as a means of avoiding the detrimental consequences of adrenal insufficiency. The advent of advanced technology in adrenal surgery has greatly facilitated the performance of partial adrenalectomy, enabling utilization of this method in an increasing number of endocrine diseases. Hereditary pheochromocytoma, Conn's syndrome, Cushing's syndrome, and non-functional adrenal masses represent the current indications for partial adrenalectomy, although the specific circumstances under which adrenal-sparing surgery should be proposed are still debatable. Partial adrenalectomy can be achieved by all types of minimally invasive surgery. In the absence of randomized, prospective, controlled studies designed to compare laparoscopic, retroperitoneoscopic, and robot-assisted partial adrenalectomy, none of these techniques has as yet been proven to be the gold standard for adrenal-sparing surgery. Apart from indications for surgery, results of surgery, and different types of partial adrenalectomy, controversial topics addressed in this review article include technical aspects such as the volume of residual adrenal tissue needed, ligation of adrenal vein, and means of tumor identification. Discussion of these controversial topics represents an attempt to define the role of partial adrenalectomy in modern adrenal surgery.

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**Effect of gauze placement soaked with adrenaline at suprabullar recess on hemostasis during endoscopic sinus surgery: A randomized controlled trial.**


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**BACKGROUND:** Topical application of vasoconstrictors is necessary for endoscopic sinus surgery (ESS) for a bloodless surgical view and reduced intraoperative
bleeding. We aimed to verify the effectiveness of gauze placement soaked with adrenaline at suprabullar recess, where the anterior ethmoidal artery exists, on hemostasis during ESS.

METHODS: A randomized, double-blinded trial was carried out for 26 patients receiving ESS. At the beginning of the surgery, gauze soaked with 2% lidocaine with or without 1:10 000 adrenaline was placed at the suprabullar recess for 8 minutes. Estimated blood loss, surgical field score, and operation time were compared between the two groups.

RESULTS: Estimated blood loss and surgical field score were significantly smaller in the adrenaline group than in the no adrenaline group. Operation time was not significantly different between the two groups.

CONCLUSION: Gauze placement soaked with adrenaline at suprabullar recess reduces estimated blood loss and clears the surgical field during ESS.

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Surgical Indications and Techniques for Adrenalectomy.
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Indications for adrenalectomy are malignancy suspicion or malignant tumors, non-functional tumors with the risk of malignancy and functional adrenal tumors. Regardless of the size of functional tumors, they have surgical indications. The hormone-secreting adrenal tumors in which adrenalectomy is indicated are as follows: Cushing's syndrome, arises from hypersecretion of glucocorticoids produced in fasciculata adrenal cortex, Conn's syndrome, arises from an hypersecretion of aldosterone produced by glomerulosa adrenal cortex, and Pheochromocytomas that arise from adrenal medulla and produce catecholamines. Sometimes, bilateral adrenalectomy may be required in Cushing's disease due to pituitary or ectopic ACTH secretion. Adenomas arise from the reticularis layer of the adrenal cortex, which rarely releases too much adrenal androgen and estrogen, may also develop and have an indication for adrenalectomy. Adrenal surgery can be performed by laparoscopic or open technique. Today, laparoscopic adrenalectomy is the gold standard treatment in selected patients. Laparoscopic adrenalectomy can be performed transperitoneally or retroperitoneoscopically. Both approaches have their advantages and disadvantages. In the selection of the surgery type, the experience and habits of the surgeon are also important, along with the patient's characteristics. The most common type of surgery performed in the world is laparoscopic transabdominal lateral adrenalectomy, which most surgeons are more familiar with. The laparoscopic anterior transperitoneal approach is the least preferred laparoscopic method in adrenalectomy. Retroperitoneal laparoscopic adrenalectomy can be performed with a posterior or lateral approach. In addition to conventional laparoscopy, laparoscopic surgery
is robot-assisted, which can be administered by transperitoneal or retroperitoneal approach. In addition, conventional or robot-assisted laparoscopic adrenalectomy can be performed transabdominally or retroperitoneally using the single-port method. Today, partial adrenalectomy can be performed using laparoscopic techniques in bilateral adrenal masses, hereditary diseases with the risk of developing multiple adrenal tumors, and solitary masses of the adrenal gland. Open surgery is indicated in the case of malignancy or suspected malignancy and large tumors when laparoscopic surgery is contraindicated. The risk of conversion to open surgery is low (approximately 5%). The open transperitoneal anterior approach is the most common open intervention, especially in large tumors with malignancy or suspected malignancy. This procedure can be performed using a midline incision, bilateral or unilateral substernal incision, Makuuchi or modified Makuuchi incision. Thoracoabdominal incision may be required, especially in the removal of large malignant lesions as a block. The open retroperitoneal approach can be applied posteriorly or laterally.

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OBJECTIVE: To explore the impact of congenital adrenal hyperplasia (CAH) on body image in Malaysian females with CAH and to understand the perspectives of these young women and their parents toward feminizing genitoplasty (FG).

DESIGN: Multi-center cross-sectional study.

SETTING: Two tertiary medical centers in Malaysia.

PARTICIPANTS: A total of 59 patients with CAH who were raised as females and more than 10 years old, and their parents.

METHODS: The CAH respondents completed the validated and translated Body Image Disturbance Questionnaires (BIDQ). All CAH respondents and their parents underwent semi-structured interviews to explore their views on FG.

MAIN OUTCOME MEASURES: Body image disturbance score and perspectives on FG.
RESULTS: The 59 CAH respondents consisted of 12 children, 29 adolescents, and 18 adults. The majority were of Malay ethnicity (64.4%) with classical CAH (98.3%) and had undergone FG (n = 55, 93.2%). For the BIDQ scores, the median score (interquartile range) for general body image was 1.29 (0.71), range 1.00-3.29, whereas the genital appearance score was 1.07 (0.39), range 1.00-4.29, revealing a greater concern for general body parts over genitalia. With regards to FG, it was perceived as necessary. Infancy and early childhood were perceived as the best timing for first FG by both respondents and parents, most preferring single-stage over 2-stage surgery.

CONCLUSIONS: General body appearance concerns were greater than for genital appearance, with more impact on the patients' lives. Contrary to much international opinion, feminizing surgery was perceived as necessary and appropriate by CAH respondents and their families, and should be offered in infancy or early childhood. Future qualitative studies are recommended.

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