INTRODUCTION

Polydactyly is considered to be one of the common congenital hand anomalies. Classification of congenital hand anomalies was reported in 1976 by Swanson. The classification groups similar forms of deficits affecting the parts that have been primarily affected by certain embryological failures. Later on, the classification was widely accepted and adopted by the American Society for Surgery of the Hand and the International Federation of Societies for Surgery of the Hand. The Swanson classification categories are (I) failure of formation of parts, (II) failure of differentiation (separation) of parts, (III) duplication, (IV) overgrowth, (V) undergrowth, (VI) congenital constriction band syndrome, and (VII) generalized skeletal abnormalities. The polydactyly can be preaxial (radial), central, or postaxial (ulnar). Polydactyly is sometimes referred to as mixed, if the condition is both radial and ulnar, or as crossed, when the feet are involved.

Background: Polydactyly is considered to be one of the common congenital hand anomalies. Classification of congenital hand anomalies by Swanson groups similar forms of deficits affected by specific embryological failures. Each type of polydactyly has its separate classification. This case series suggested classification that could include the radial and ulnar variants of polydactyly in one classification and direct the management in algorithmic approach.

Methods: Case series of 11 cases, who were diagnosed with polydactyly of the hand consecutively at King Abdulaziz Medical City in Jeddah, Saudi Arabia. Cases were described by physical assessment and x-ray, then categorized by the proposed MAS classification.

Results: Description of 11 cases by the suggested MAS classification: A- Soft tissue attachment. B-Bone attachment. I. Attached to metacarpal bone. II. Attached to the proximal phalanx. III. Attached to the middle phalanx. IV. Attached to the distal phalanx. C-Joint attachment. I. Attached to carpometacarpal joint. II. Attached to metacarpophalangeal joint. III. Attached to the proximal interphalangeal joint. IV. Attached to the distal interphalangeal joint. Treatment according to the algorithmic approach: type A, treat it with soft-tissue excision; type B, bony excision with or without reinsertion of abnormal muscle attachment; and type C, excision of collateral ligaments and reconstruction with or without K wire fixation and reinsertion of abnormal muscle attachment.

Conclusions: MAS classification demonstrates a potential to be applied to both ulnar and radial polydactyly. It is simple, easy to recall, anatomically and surgically oriented for practical purposes. Thus, it needs to be validated in extensive studies.
and Mckusick in 1978. Type A is a well-formed extra digit that articulates with little finger metacarpal or extra metacarpal, and type B is poorly developed usually skin tag. The aim of this case series study was to propose MAS classification that may include the radial and ulnar variants of polydactyly in one classification and direct the management in algorithmic approach. MAS classification is simple to recall, easy to apply, anatomically and surgically oriented.

**MATERIALS AND METHODS**

A case series study of 11 cases, who were diagnosed with polydactyly of the hand consecutively at King Abdulaziz Medical City in Jeddah, Saudi Arabia. Data were collected from patient charts and parents during clinic visits, which included demographics, family history, perinatal history, and associated systemic anomalies. The type of polydactyly was described by physical assessment and x-ray, then categorized by the suggested MAS classification (Figs. 1, 2).

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**Algorithm of MAS classification**

**polydactyly**

- History, Physical exam
  - *Rule out other congenital anomalies.

- X-Ray
  - Plan treatment before 24 months.

- **A**
  - Soft Tissue Attachment
  - Soft tissue Excision.
  - *Prevent neuroma
  - & painful scar.
  - By Excision of Extra nerve under tension.

- **B**
  - Bone Attachment
  - Bony Excision.
  - *+/− Re-insertion of Abnormal Muscle Attachment.

- **C**
  - Joint Attachment
  - Excision of collateral ligaments
  - & Re-construction.
  - *+/− K wire fixation.
  - *+/− Re-insertion of Abnormal Muscle Attachment.

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Fig. 1. Algorithm of MAS classification.
RESULTS
Description and classification of 11 cases of polydactyly using the proposed MAS classification (Tables 1–11; Figs. 3–10).

DISCUSSION
This case series study was held in King Abdulaziz Medical City in Jeddah. It is basically devoted to the care of national guard’s families with very restricted access for general population. The study was only for 1 month in duration. Also, the majority of families of patients with mild forms of polydactyly just tend to ignore it without seeking any surgical intervention; all of these reasons had led to the limited number of cases presented in this study. The currently used classification systems for polydactyly, despite their rationality, do not address the surgical decision of management as reported by Evanson et al., which clarifies the need for a classification that includes all types of polydactyly with an algorithmic approach to guide the management. More than 300 syndromes were reported with both types of polydactyly. In our study, all the cases were isolated polydactyly and not part of a syndrome.
Treatment options for polydactyly described in the literature are ligation, surgical excision, and surgical reconstruction. Our proposed study algorithm is consistent with these management options.

The main purpose of treatment of polydactyly is preserving hand function and allowing maximal cerebral

Table 1. Bilateral Ulnar Polydactyly (Fig. 3)

| Swanson classification | MAS classification |
|------------------------|--------------------|
| Left and right, type III, duplication | Left hand type C I (attached to CMCJ) |
| Temtamy and McKusick classification | Right hand type C II (attached to MCPJ) |

CMCJ, carpometacarpal joint; MCPJ, metacarpophalangeal joint.

Table 2. Bilateral Ulnar Polydactyly (Fig. 4)

| Swanson classification | MAS classification |
|------------------------|--------------------|
| Type III, duplication | Type A (soft tissue) |
| Temtamy and McKusick classification | Type B is poorly developed |

Table 3. Unilateral Ulnar Polydactyly (Fig. 5)

| Swanson classification | MAS classification |
|------------------------|--------------------|
| Type III, duplication | Type B IV (attached to bone -distal phalanx) |
| Temtamy and McKusick classification | Type B is poorly developed |

Table 4. Unilateral Ulnar Polydactyly

| Swanson classification | MAS classification |
|------------------------|--------------------|
| Type III, duplication | Type A (soft tissue) |
| Temtamy and McKusick classification | Type B is poorly developed |

Table 5. Unilateral Radial Polydactyly (Fig. 6)

| Swanson classification | MAS classification |
|------------------------|--------------------|
| Type III, duplication | Type A (soft tissue) |
| Wassel classification | N/A |

N/A, not applicable.

Table 6. Bilateral Ulnar Polydactyly

| Swanson classification | MAS classification |
|------------------------|--------------------|
| Left and right type III, duplication | Left hand type C I (attached to CMCJ) |
| Temtamy and McKusick classification | Right hand type C II (attached to MCPJ) |

CMCJ, carpometacarpal joint; MCPJ, metacarpophalangeal joint.

Table 7. Unilateral Ulnar Polydactyly

| Swanson classification | MAS classification |
|------------------------|--------------------|
| Type III, duplication | Type A (soft tissue) |
| Temtamy and McKusick classification | Type B is poorly developed |

Table 8. Unilateral Ulnar Polydactyly (Figs. 7, 8)

| Swanson classification | MAS classification |
|------------------------|--------------------|
| Type III, duplication | Type B I (attached to metacarpal) |
| Temtamy and McKusick classification | Type B is poorly developed |

Table 9. Bilateral Ulnar Polydactyly (Fig. 9)

| Swanson classification | MAS classification |
|------------------------|--------------------|
| Type III, duplication | Both are type C II (attached to MCPJ) |
| Temtamy and McKusick classification | Type A well-developed digit articulating with existing metacarpal bone |

Table 10. Unilateral Ulnar Polydactyly

| Swanson classification | MAS classification |
|------------------------|--------------------|
| Type III, duplication | Type A (soft tissue) |
| Temtamy and McKusick classification | Type B is poorly developed |

Table 11. Bilateral Ulnar Polydactyly (Fig. 10)

| Swanson classification | MAS classification |
|------------------------|--------------------|
| Left and right type III, duplication | Left and right-hand type C II duplication (attached to MCPJ) |
| Temtamy and McKusick classification | Type A well-developed digit articulating with existing metacarpal |

Fig. 3. X-ray Showing bilateral ulnar polydactyly.

Fig. 4. Bilateral ulnar polydactyly.
functioning of the hand parts by intervening surgically earlier at the age of 2 years. Appearance and social approval are also essential elements to consider during the decision of timing of intervention preferably before preschool age.

The step by step approach of our algorithm has both therapeutic and prognostic relevance that allows surgical intervention to be defined for each class and type.

The complications of surgical intervention for polydactyly are instability of the metacarpophalangeal joint and ligaments and excessive tension of the intrinsic muscles as described by Light. If ligation was used rather than surgery, the rate of infection or gangrene of small nubbin due to left tissues or retained cartilage is high.

Our proposed MAS classification for polydactyly could be comprehensive, practical with an algorithmic approach.
CONCLUSIONS

The quest for finding one classification that can be applied to different types of polydactyly and also to classify types that could not be classified by the well-known classifications in the literature was the motive for our study. We suggested a classification that could be applied on both ulnar and radial polydactyly. A classification that is simple, easy to recall, and has a treatment algorithm for practical purposes. Therefore, we recommend the classification to be validated in extensive studies.