Didactic: Pelvic Anatomy Roadmap:
Surgical Navigation & Repair of Complications

PROGRAM CHAIR
Javier F. Magrina, MD

Kristina A. Butler, MD  Mario M. Leitao, MD  Paul M. Magtibay, MD
Professional Education Information

Target Audience
This educational activity is developed to meet the needs of residents, fellows and new minimally invasive specialists in the field of gynecology.

Accreditation
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This course provides a review of the intraperitoneal and retroperitoneal pelvic anatomy applied to MIS gynecologic surgery. Retroperitoneal anatomy as it applies to prevention of ureteral dissection, management of pelvic bleeding including presacral bleeding, prevention of nerve injuries, and dissection of lateral pelvic spaces are some of the anatomical details to be presented. In addition, management of urologic and bowel injuries with anatomical description will be presented.

Learning Objectives: At the conclusion of this course, the clinician will be able to: 1) Identify the retroperitoneal anatomy for the dissection of lateral pelvic spaces; 2) describe a plan and techniques for the control of pelvic and presacral bleeding; and 3) identify and discuss the principles of prevention and management of urologic and intestinal injuries.

Course Outline

7:00 Welcome, Introductions and Course Overview  J.F. Magrina
7:05 Lateral Pelvic Wall: How to Navigate through the Lateral Spaces to Safely Identify Important Vessels and Nerves. Bleeding Control: Uterine and Hypogastric Artery Ligation  J.F. Magrina
7:30 Presacral Space: Anatomy, Dissection, Management of Presacral Bleeding, from Mild to Severe  P.M. Magtibay
7:55 Colorectal Anatomy, Role of Bowel Preparation and Management of Colorectal Injury  M.M. Leitao
8:20 Retroperitoneal Nerves: Dissection, Identification, Sacral Nerve Roots, Prevention and Management of Nerve Injury  K.A. Butler
8:45 Questions & Answers  All Faculty
8:55 Break
9:10 Parametrial Ureter: Anatomy: Ureteral Dissection, from Easy to Difficult  J.F. Magrina
9:35 Prevention and Repair of Urologic Injuries: A Must for All Gynecologists; Use of Cystoscopy  P.M. Magtibay
10:00 Anatomy of Large Pelvic Vessels and Handling Major Vascular Injuries  M.M. Leitao
10:25 Aortic and Para-Aortic Anatomy in Gynecology: Dissection, Exposure, Vascular Anomalies  K.A. Butler
10:50 Questions & Answers  All Faculty
11:00 Adjourn
PLANNER DISCLOSURE
The following members of AAGL have been involved in the educational planning of this workshop and have no conflict of interest to disclose (in alphabetical order by last name).
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Amber Bradshaw
Speakers Bureau: Myriad Genetics Lab
Other: Proctor: Intuitive Surgical
Erica Dun*
Frank D. Loffer, Medical Director, AAGL*
Linda Michels, Executive Director, AAGL*
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Kristina A. Butler*
Mario M. Leitao
Other: Ad hoc speaking and lab proctor: Intuitive Surgical
Javier F. Magrina*
Paul M. Magtibay*

Asterisk (*) denotes no financial relationships to disclose.
Lateral Pelvic Wall: How to Navigate through the Lateral Spaces to Safely Identify Important Vessels and Nerves. Bleeding Control: Uterine and Hypogastric Artery Ligation

Disclosure

I have no financial relationships to disclose.

Objectives

Discuss how to navigate the lateral spaces and safely identify important vessels and nerves.

Enemies

• external and common iliac art.
• obturator nerve
• lumbosacral trunk
• ureters

Friends

• Superior vesical artery
• Uterine artery
• Internal iliac artery
Hypogastric artery branching
“...the manner of branching departs so frequently from the so-called standard pattern that it is usually impossible to identify the various vessels without following them for some distance to ascertain their course and destinations”

Ashley FL, Anson BJ. Am J Phys Anthropol 28:381, 1941

Most aberrant artery of internal iliac branches:
obturator artery

Ashley FL, Anson BJ. Am J Phys Anthropol 28:381, 1941

Practical branching of internal iliac artery

- Anterior: superior vesical, uterine
- Lateral: int. pudendal, inf. gluteal
- Posterior: superior gluteal

- 2.7 cm distal to common iliac bifurcation
  Posterior branch
  - 5 mm diameter
  - Branches: superior gluteal, iliolumbar, lumbosacral

Internal iliac branching

- 9 types
- 49 subtypes
Obturator nerve anomalies

• Distal fusion of L3-4 ventral rami
• Proximal intrapelvic bifurcation

Ashley FL, Anson BJ. Am J Phys Anthropol 28:381, 1941
Presacral Space: Anatomy, Dissection Management of Presacral Bleeding from Mild to Severe

Paul M Magtibay, MD

Mayo Clinic Arizona

OBJECTIVES

- Define the vascular anatomy and anatomic boarders of the presacral space
- Discuss reasons for dissection of the space
- Discuss management of presacral bleeding*
- Demonstrate the dissection of the presacral space

Presacral Bleeding

- Prevention
  - Know anatomic landmarks
  - Practice developing the space
  - Be smart
    - Sacrocolpopexy
    - Rectal resection: benign versus malignant versus presacral tumors
    - Use available technology: sealing devices
    - Be aware of hemostatic agents available

Presacral Bleeding

- Preparation & Stabilization
  - Pressure
  - IV access
  - Massive Transfusion Protocol
  - Suction x 2 or x 3
  - Hands / Help

I have no financial relationship to disclose.
Presacral Bleeding

- Control
  - Pressure
  - Electrocautery
  - Suture: caution

Presacral Bleeding

- Control
  - Topical hemostatic agents:
    - Floseal (bovine gelatin/human thrombin), Collagen hemostat (instat, avitene), Oxidized cellulose (surgicel, oxycel), Gelatin foam/sponge (gelfoam, surgifoam), Vasopressin (soaked packing), Fibrin glue, Thrombin
    - Thumb tacks: nope
    - Bone wax: nope

Presacral Bleeding

- 4 x 2 cm segment of rectus abdominis muscle
- Hold over bleeding with forceps
- Cautery at 100 Hz
- Vigorous suctioning
- Fragment may not “stick”

Harrison; Dis Colon Rectum 2003

Presacral Bleeding

- Control
  - Tightly pack
  - Leave abdomen open
  - ICU
    - Correct DIC
    - Bring back when more stable

Videos

REFERENCES

Colorectal Anatomy, Role of Bowel Preparation and Management of Colorectal Injury

Mario M. Leitao, Jr., MD
Associate Professor, Weill Cornell Medical College
Associate Member, Gynecology Service
Director, Gynecologic Oncology Fellowship Program
Director, Minimal Access and Robotic Surgery (MARS) Program
Department of Surgery
@leitaomd

Disclosure
Other: Ad hoc speaking and lab proctor: Intuitive Surgical

Objective
Discuss colorectal anatomy, role of bowel preparation and the management of colorectal injury.

Anatomy
Bowel preparation
### Mechanical Bowel Prep

**Postop outcomes meta-analysis**

<table>
<thead>
<tr>
<th>Outcome</th>
<th>Prep (%)</th>
<th>No-prep (%)</th>
<th>OR</th>
<th>95% CI</th>
</tr>
</thead>
<tbody>
<tr>
<td>Anastomotic leak</td>
<td>5.6</td>
<td>2.8</td>
<td>1.85</td>
<td>1.06 – 3.23</td>
</tr>
<tr>
<td>Intra-abdominal infection</td>
<td>3.7</td>
<td>2.0</td>
<td>1.65</td>
<td>0.76 – 3.57</td>
</tr>
<tr>
<td>Wound infection</td>
<td>7.1</td>
<td>5.5</td>
<td>1.38</td>
<td>0.82 – 2.35</td>
</tr>
<tr>
<td>Re-op rates</td>
<td>5.4</td>
<td>2.2</td>
<td>2.42</td>
<td>0.81 – 7.15</td>
</tr>
<tr>
<td>General M&amp;M</td>
<td>19.4</td>
<td>12.7</td>
<td>1.55</td>
<td>0.79 – 3.10</td>
</tr>
<tr>
<td>Mortality</td>
<td>1.0</td>
<td>0.5</td>
<td>2.03</td>
<td>0.37 – 12.25</td>
</tr>
</tbody>
</table>

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**Mechanical Bowel Prep**

**Laparoscopy**

---

**Mechanical Bowel Prep**

**Laparoscopy**

---

**Injury management**

---

**Traumatic Colon Injury**

**Unprepped bowel**

---

---
**Traumatic Rectal Injury**

*Unprepped bowel*

---

**Major Vascular Injury**

*Converting considerations*

- Robot can be undocked very quickly if needed
- Put all instruments in view
- Pull them all out with trocars still attached to robotic arms
- Can leave one arm attached that is grasping vessel, remove all others, pull them as far away as possible and convert
- Apply bulldog clamps over site, proximal/idstal, whatever works and then undock and convert

---

"**Mistakes are always forgivable, if one has the courage to admit them.**"

—Bruce Lee

---

**THANK YOU!**
Retroperitoneal Nerves: Dissection, Identification, Sacral Nerve Roots, Prevention and Management of Nerve Injury

Kristina A. Butler, M.D.

Objectives

• Review pertinent retroperitoneal nerves
• Plan for safe dissection and avoid injury
• Discuss management of nerve injury

Disclosures

I have no financial relationships to disclose.

Lumbar Plexus

Sacral Plexus

Sacral Nerve Roots

Causes of Injury

- Direct injury
  - Transection
  - Entrapment
- Compression
- Stretch
- Ischemic

Risk factors

- Body habitus
- Age
- Vascular disease: tobacco use
- Hypotension, hypothermia
- Preexisting conditions
- Duration of surgery

References:
- Warner M. Anesth. 2000
- Irvin. AOG. 2004
- Barber. AOG. 2009
Positioning

• Secure safety
• Maintain natural positions
• Surgical access

Genitofemoral
– L1-2
– Sensory: Mons, labia, thigh

Lateral Femoral Cutaneous
– L2-3
– Sensory: lateral thigh

Genitofemoral
– L1-2
– Sensory: Mons, labia, thigh

Lateral Femoral Cutaneous
– L2-3
– Sensory: lateral thigh

Warner M. Anesth. 2000

Femoral Nerve

• L2-4
  – Lateral to psoas muscle
  – Passes under inguinal ligament
  – Lateral femoral triangle

Femoral Nerve Injury

• Motor innervation
  – Hip flexion
  – Knee extension

• Anteromedial thigh & leg numbness

• Deep tendon reflexes
**Retractor Compression**

**Obturator Nerve**
- L2-4
  - Formed within the psoas muscle
  - Pelvic sidewall
  - Exits pelvis, Obturator canal
- Motor: Adductors
- Sensory: Skin medial thigh

**Sciatic Nerve**
- L4-S3
- Exits pelvis below piriformis muscle
- Beneath gluteus
- Lateral of ischial tuberosity, enters thigh

**Management of Injury**
- Injury: Foot drop, buttock/leg pain
- Avoid: hip flexion with leg extension

**Sciatic Nerve**
- Motor: hip extension, leg/foot flexion
- Sensory: posterior leg/thigh
Evaluation of injury

- Examination
- Sensory deficit
  - Conservative measures
- Motor deficit
  - Neurology consultation
  - Nerve conduction study
  - Physical therapy

Summary

- Perioperative nerve injury is often avoidable
- Nerve injury can be severe, permanent, & disabling
- Thoughtful positioning & dissection can reduce the risk of injury

References


Thank you

Acknowledge: M Warner, M.D.
Objectives

• Discuss parametrial ureteral anatomy

The incidence of ureteral injuries in gynecologic laparoscopic surgery during the past 15 years has:

• A. decreased
• B. remained the same
• C. increased
• D. don’t know

Laparoscopic ureteral injuries

<table>
<thead>
<tr>
<th>Year</th>
<th>%</th>
</tr>
</thead>
<tbody>
<tr>
<td>2002</td>
<td>0.03-0.5* (1.7)</td>
</tr>
<tr>
<td>2009</td>
<td>0.03-0.7** (1.6)</td>
</tr>
<tr>
<td>2014</td>
<td>0.02-0.4***</td>
</tr>
</tbody>
</table>

*Clin Obstet Gynecol 45: 469, 2002
**Clin Obstet Gynecol 52:201, 2009
***JMIG 21:558, 2014 (only hyst)

Open + vaginal hyst 1984-90 0.3-1.5%
Intraoperative diagnosis of ureteral obstruction is associated with:

- A. Increased permanent sequelae
- B. Malpractice lawsuit
- C. Reduced need of ureteral surgery
- D. Requires urological consultation

Laparoscopic ureteral injuries

Need for ureteral surgery

<table>
<thead>
<tr>
<th>intraop dx</th>
<th>postop dx</th>
</tr>
</thead>
<tbody>
<tr>
<td>14%</td>
<td>86%</td>
</tr>
<tr>
<td>9%</td>
<td>61%</td>
</tr>
</tbody>
</table>

N=157 Lit review
JMG 2014; 21:558

Parametrial ureter

How close can the ureter be to the cervix?

- A. < 0.5 cm
- B. 1 cm
- C. 1.5 cm
- D. 2.0 cm

12% of ureters are within 0.5 cm
1 in 8 patients


What % of ureteral injuries are diagnosed at intraoperative cystoscopy?

- A. 30
- B. 40
- C. 50
- D. 60
- E. None of the above
Urinary injuries in laparoscopy

Diagnosis at cystoscopy

95% of ureteral injuries

85% of bladder injuries

Thank you
Prevention and Repair of Urologic Injuries: A Must for All Gynecologists; Use of Cystoscopy

Paul M Magtibay, MD
Mayo Clinic Arizona

I have no financial relationships to disclose.

- Reference the incidence of lower urinary tract injury in gynecologic surgery
- Discuss the role of cystoscopy at the time of gynecologic surgery
- Demonstrate the principles in the repair of common lower urinary tract injuries

Lower Urinary Tract Injury
It Will Occur

- Immediate Recognition
  - Easier to repair
  - More successful repair
  - Reduced morbidity to patient
  - Less surgeon stress
  - Advantageous legally
  - Do cystoscopy

Lower Urinary Tract Injury
Gilmour et al

- No cystoscopy (107,068)
  - Bladder Injury: 2.6 / 1000
  - Ureteral Injury: 1.6 / 1000
  - 15.5% ureteral and 92% bladder injuries recognized intraoperatively
  - 97% of bladder injuries recognized postoperatively presented as vesicovaginal fistulas

- Cystoscopy (89,754)
  - Bladder Injury: 10.4 / 1000
  - Ureteral Injury: 6.2 / 1000
  - 90% ureteral and 95% bladder injuries recognized and managed successfully intraoperatively
Cystoscopy

- Minimal
  - Risk: UTI
  - Expense
  - Time
- Standard of Care
  - Urogynecology

- Do cystoscopy

Bladder Endometriosis

Closure Cystostomy

Ureteral Endometriosis

Uretero-Neocystostomy

Ureteral Transection

Uretero-Ureterostomy

REFERENCES

Anatomy of Large Pelvic Vessels and Handling Major Vascular Injuries

Mario M. Leitao, Jr., MD
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Associate Member, Gynecology Service
Director, Gynecologic Oncology Fellowship Program
Director, Minimal Access and Robotic Surgery (MARS) Program
Department of Surgery
@leitaomd

Disclosure
Other: Ad hoc speaking and lab proctor: Intuitive Surgical

Objective
Discuss pelvic vascular anatomy and injury management.

Pelvic Vascular Anatomy

Essential Basic Tips in Avoiding Complications “APTESS”

- Anatomy - master anatomy
- Principles – master surgical principles
- Tools – master your tools
- Exposure – maximize exposure
- Structures – maximize identification of structures
- Standardize – techniques across all surgeons
MIS: 2 categories of injury

At insertion - laparoscopy
- About 10⁻³ to 10⁻⁴
- 83% of injuries reported L-scopy
  - 44% Veress Needle, 39% trocar (half disposable)

During MIS
- Gas embolus
- O₂ sat, arryth., hypoT, mill wheel
- Rt sided failure
- Remove Veress, 100% O₂, Trend, Rt Atrium. Cath.

Exsanguination
- Immediate Hemoperitoneum 88%
- Delayed retroperitoneal hematoma 12%
- About 10% mortality

Borrowed: P. Escobar, MD
Instrumentation
Vascular Sutures

Primary Repair of Arteriotomy

- Vessel should be manipulated by grasping the peri-arterial or adventitial tissues only—if possible
- it is advisable for the needle to pass from inside to out (i.e. from intima to adventitia)
- Non-absorbable, monofilament suture material
- The finer the vessel, the finer the sutures required and the smaller the bites taken
- The suture line needs to be everted to result in good intimal apposition, unlike a bowel anastomosis in which the suture line tends to be inverted.

Venous Injuries

- Potential catastrophic complications and carry substantial risk for death
- Iatrogenic venous trauma appears considerably more common than arterial injury
- Nearly always is more difficult to control because venous bleeding pools directly in the field of repair
- Blood loss from injuries of the IVC or internal iliac vein may be substantial (mean 4,800–7,300 ml)

Avulsion Injury

Burn Injury

Bottom Line

- Learn from one’s missteps
- Self-evaluate
- Work towards improvement
- Sensor over platform pedals
- New scissor tip cover
- Better prepare for these emergent situations and have plan in mind
Emergent Conversion for Major Complication

- Mostly vascular emergencies
- Gowns and gloves always open and available for all console surgeons
- Robot emergency "team timeout" done during "Contingency Plan" section of active timeout for each case

<table>
<thead>
<tr>
<th>Emergent转化 Options</th>
<th>Description</th>
</tr>
</thead>
<tbody>
<tr>
<td>Attending Surgeon</td>
<td>1. Call for emergent conversion to open procedure, designate person in charge of maintaining tamponade.</td>
</tr>
<tr>
<td>Circ RN</td>
<td>2. Push Code &quot;blue&quot; button or call central desk. Turn on OR lights.</td>
</tr>
<tr>
<td>Circ RN</td>
<td>3. Open Robotic Emergency Tray</td>
</tr>
<tr>
<td>Anesthesia team</td>
<td>4. Notify anesthesia attending on Vocola</td>
</tr>
<tr>
<td>Anesthesia team</td>
<td>5. Initiate IV fluid resuscitation. Confirm adequacy of IV access.</td>
</tr>
<tr>
<td>Anesthesia team</td>
<td>6. Request blood products. Request confirmation when sent.</td>
</tr>
<tr>
<td>Bedside assistant</td>
<td>7. Maintain tamponade, may initiate removal of some robotic instruments at the discretion of attending surgeon</td>
</tr>
<tr>
<td>Attending Surgeon</td>
<td>8. Undock Robot at direction of Attending Surgeon</td>
</tr>
<tr>
<td>Attending Surgeon</td>
<td>9. Proceed to open</td>
</tr>
<tr>
<td>Circ RN</td>
<td>10. Notify all available service attendings for additional help</td>
</tr>
</tbody>
</table>

Major Vascular Injury
Basic tips & common sense approach

- Have a "timeout" process in place for each case
- Have vascular instruments handy for each case
- DO NOT start randomly moving or removing instruments
- Grasp bleeding vessel with robotic grasper
- Throw in sponge
- Relax, take charge, and plot out next steps (robot won't move)
- Call for laparotomy set up
- Call for laparoscopic bulldog clamps, 5-0 prolene sutures, hemostatic agents
- Find out who is around who can truly help
- Convert to laparotomy any time uncomfortable and before too late
- Obtain best exposure surrounding site of injury
- Assess extent of injury
- Attempt repair if possible
- If not, call for help if none there yet and convert

Major Vascular Injury
Converting considerations

- Robot can be undocked very quickly if needed
- Put all instruments in view
- Pull them all out with trocars still attached to robotic arms
- Can leave one arm attached that is grasping vessel, remove all others, pull them as far away as possible and convert
- Apply bulldog clamps over site, proximal/distal, whatever works and then undock and convert
THANK YOU!
Aortic Anatomy in Gynecology:
Dissection, Exposure,
Vascular Anomalies
Kristina A. Butler, MD
Gynecologic Oncology
Mayo Clinic Arizona

Objectives
• Review pertinent aortic anatomy
• Plan for safe exposure of the aortic region
• Discuss minimally invasive surgical techniques for accessing the aortic area

Aortic Anatomy
• Dissection Boundaries
• Vessels
  – Renal
  – Gonadal
  – Lumbar
  – Sacral
  – Mesenteric

Disclosures
I have no financial relationships to disclose.

• SMA
• Adrenals
• Gonadals
• IMA
Renal anomalies

Retroaortic renal vein
Low renal vein
Very low renal vein

Variations

• Review Imaging Preop

• Video

Map your course before the trip

Aortic Anatomy

• Dissection Boundaries
  • Vessels
    – Renal
    – Gonadal
    – Lumbar
    – Sacral
    – Mesenteric
  • Nerves

• Autonomic
• Somatic

Aortic Anatomy
• Dissection Boundaries
• Vessels
  – Renal
  – Gonadal
  – Lumbar
  – Sacral
  – Mesenteric
• Nerves: Sympathetic
• Ureters

Lymphadenectomy Techniques: MIS
• Robotic
  • Supine flat
    – Inferior docking (perineum, hip)
    – Superior docking (shoulder, cranial)
• Lateral decubitus
• Laparoscopic
  – Extraperitoneal
  – Transperitoneal

Pelvic Access:
• Hip docking (perineal) umbilical center

Pelvic Access:
• Hip docking (perineal) supraumbilical center
**Table rotation**

**Aortic Access:**
- Cranial docking
- Low pelvic trocars, table rotation

**Aortic Access:**
- Shoulder docking
- Low pelvic trocars, table rotation

**Aortic Dissection Steps**
- Incise right common iliac peritoneum, parallel vessel, midpoint of artery
- Nodal tissue separated dorsal, away from peritoneal tent
- Right ureter elevated/lateralized, attached to peritoneum
- Mobilize duodenum to reach renal vein
- Remove right aortic nodes
- Extend peritoneum toward left mid-common iliac artery
- Left ureter lateralized
- IMA isolated
- Remove left aortic nodes to left renal vein

**Video**
Left Lateral Approach

Extraperitoneal Approach

Aortic access:
Left flank trocars

References


Thank you
CULTURAL AND LINGUISTIC COMPETENCY

Governor Arnold Schwarzenegger signed into law **AB 1195 (eff. 7/1/06)** requiring local CME providers, such as the AAGL, to assist in enhancing the cultural and linguistic competency of California’s physicians (researchers and doctors without patient contact are exempt). This mandate follows the federal Civil Rights Act of 1964, Executive Order 13166 (2000) and the Dymally-Alatorre Bilingual Services Act (1973), all of which recognize, as confirmed by the US Census Bureau, that substantial numbers of patients possess limited English proficiency (LEP).

California Business & Professions Code §2190.1(c)(3) requires a review and explanation of the laws identified above so as to fulfill AAGL’s obligations pursuant to California law. Additional guidance is provided by the Institute for Medical Quality at [http://www.imq.org](http://www.imq.org).

Title VI of the Civil Rights Act of 1964 prohibits recipients of federal financial assistance from discriminating against or otherwise excluding individuals on the basis of race, color, or national origin in any of their activities. In 1974, the US Supreme Court recognized LEP individuals as potential victims of national origin discrimination. In all situations, federal agencies are required to assess the number or proportion of LEP individuals in the eligible service population, the frequency with which they come into contact with the program, the importance of the services, and the resources available to the recipient, including the mix of oral and written language services. Additional details may be found in the Department of Justice Policy Guidance Document: Enforcement of Title VI of the Civil Rights Act of 1964 [http://www.usdoj.gov/crt/cor/pubs.htm](http://www.usdoj.gov/crt/cor/pubs.htm).

Executive Order 13166, “Improving Access to Services for Persons with Limited English Proficiency”, signed by the President on August 11, 2000 [http://www.usdoj.gov/crt/cor/13166.htm](http://www.usdoj.gov/crt/cor/13166.htm) was the genesis of the Guidance Document mentioned above. The Executive Order requires all federal agencies, including those which provide federal financial assistance, to examine the services they provide, identify any need for services to LEP individuals, and develop and implement a system to provide those services so LEP persons can have meaningful access.

Dymally-Alatorre Bilingual Services Act (California Government Code §7290 et seq.) requires every California state agency which either provides information to, or has contact with, the public to provide bilingual interpreters as well as translated materials explaining those services whenever the local agency serves LEP members of a group whose numbers exceed 5% of the general population.

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